

SOME
CONSIDERATIONS
Touching the
VSEFVLNESSE
Of EXPERIMENTAL
Natural Philosophy.

Propos'd in a Familiar Discourse to a Friend,
by way of *Invitation* to the Study of it.

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The PUBLISHER to the READER.

IT is, Courteous Reader, part of the Satyr of *Petronius* against the Vice of his own Time, *Priscis temporibus, cum adhuc nuda Virtus placeret, vigeabant Artes ingenuæ, summumque certamen inter homines erat, ne quid profuturum sæculis diu lateret. Democritus omnium Herbarum succos expressit, & ne Lapidum virgultorumque vis lateret, ætatem inter Experimenta consumpsit.* Other Examples of the like Industry he brings, and then concludes against the Laziness and Luxury of his own Age. *At nos, saith He, ne paratis quidem Artes audemus cognoscere, sed accusatores Antiquitatis vitia tantum docemus & discimus.* It was for want of a *Democritus* or two that he casts this hard Censure upon his own Time. For not-

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withstanding all his Harangue in Commendation of some Ages which were antient to his Own, it is evident out of History, that there was never at once any great Number, who seriously and in earnest for the Benefit of Mankind applied themselves to these severe Scrutinies of Natural Bodies. It is true that now and then, in all Centuries from the Beginning of the World, there have appear'd some persons of a Nature more refin'd, as if indeed (according to that Phancy of the Old Poets) some *Promethæus* had made them either of another Metal, or of another Temper, from the Vulgar, utterly above all Mixture with, or Embasement by the common Fashions of this World; who did make it the End of their Lives, by Severing and Mixing, Making and Marring, and multiplying variety of Experiments on all Bodies, to discover their hidden Virtues, and so to enlarge the Power and Empire of Man. But these were ever very few and singular. Even in that so much celebrated Time of *Democritus* these Studies were so rare, that his usual Exercise of the Anatomy of Beasts was look'd upon, as that which made the Soundnesse of his Mind questionable, even as a spice of Madesse in him: and probably much more might the Vulgar of his Age have been amused, had they

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they seen him torturing Minerals and Metals in the more toilsome Anatomy of Fire.

Now if it be a dishonourable Crimination to an Age, that it hath brought out no Persons who make it their great Endeavour *Ne quid profuturum saculis lateat*: and if the Discovery of one or two persons of this Kind be enough to expiate for, and take off the Dishonour of the Proletarian Laziness and Luxury of the rest, I think I may justly esteem that the exhibiting to the World the History of the Studies of the Honourable Author of this Piece may serve to be the Apology and Defence of our Age against such Censures, as that wherewith the newly cited *Satyrist* stained his own time.

And this was one great Reason that hath made me very forward to promote the Publication of This, and divers other Writings of the same Noble Author. For were there onely Tokens of Endeavour in Them, the proof of this Endeavour (even without Attainment) ought to wipe off all Imputations of this nature. But this Motive (though I do account that by exhibiting this Expiation I do somewhat oblige the Age, whose Honour is thereby defended, yet) was far from being the most great and forcible. For the Excellence of the Works themselves,

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selves, even as soon as they fell from the pen of the Author, did long since in all Equity set an *Imprimatur* on them.

*Nec sumunt aut ponunt secures
Arbitrio popularis Aura.*

Epicurus, when he was casting up the account of his life, upon the very Day of his Death, mentions a very great pleasure that he even then took in two parts of his former Studies: And these were his *Rationes*, and his *Inventa*; *Points well argued*, and *things happily found out*. The two very same Particulars are principally conspicuous in this ensuing Piece. There are good Conclusions against the Enemies of the Being and Providence of God in the First Part, and in the Second there be Notices of divers *Inventa* profitable to the Use of Man. By the one, sound Notions are proposed to the Readers apprehension from the Contemplation of God's Creation and Government of the World, and thereby good Matter is suggested to his Affections for the Advancement of his Devotion; by the Other, there are divers things deliver'd, which may tend to enlarge Man's power of doing Good: By them, in the whole, both our Honour to God, and our Charity to our Neighbors may

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may be assisted: in which two the Substantial part of all the most Noble, not onely Humane but Christian Virtues, both Speculative and Practical, are certainly contained.

I must not omit, that an Argument of this Nature, at this Time, may justly be commended for its Seasonableness, when divers Persons, who know not the way of *Experimental Philosophy*, and are loath now to give themselves the trouble of learning it, have been making some attempts, very unthankfully to traduce both it, and its Promoters.

These Considerations passed with me for Reasons, and had upon me this force and prevalence, that as soon as I had the Author's leave, I durst not forbear the committing of them to the Presse, notwithstanding his many Arguments, which were plausible enough to the Contrary: as, namely, that much of the *First Part* was written when he was of so immature Years, that should I be particular concerning his Age then, to any person who hath read the piece, the paucity of such Instances might justly make me despair of begetting Credit to my Relation. Another Objection was, That, though his Method did of necessity lead him to it, yet it might be look'd upon as unbecomming for Him to meddle

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meddle with the Physician's Art, of which he never did, (nor could, by reason of his Native Honour) make any Profession. But these Oppositions being raised upon points of Curiosity in Ceremony and outward *Decorum*, were of little weight, when the forementioned Noble Offices of Charity and doing good were in the other Scale.

The greater Question was. Suppose them to be published, But why now? Why so soon? Should not rather the Edition have been delayed, until it might have come out together with *The second Section of the second Part?* (which discovers the Use that may be made of Experimental Learning, to advance the Empire of Man over other Creatures) or untill the Common preface, and some other little Tracts, all written long since, and intended to accompany this, might be revised by the Author; or at least untill the Author might have had leisure to have made some more new and full Animadversions to the Receipts and processes contain'd in the Appendix? The Consideration which answer'd this Objection was, That this Piece, as now Printed alone, would make (as you see it doth) a very competent Book, which would have by it Self the perfection, if not of the Whole, yet of a more principal part; and of that part, which to
Professors

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Professors or Candidates of Learning is most desirable. And then the Author's Avocations and other Studies being so many, that we could prefix no certain time for the complement of the mention'd remaining parts, I was loath to hazard the Preservation of These by deferring the Impression, since I know there is no Security of the Continuance of those Writings which are reposed onely in single, or at most in few written Copies. I remember, the Author had once lost for a good while one of these very Essays which are now here Printed, and put beyond that Danger for the future. Besides other Casual accidents, the very Contingency of Humane life, and the chance of a man's Papers after Death, (for to them the Question of King Solomon is most proper and pertinent, *Who knows whether then they may happen to fall into the hands of a wise man or a fool?*) were of force enough to perswade me to secure these when it was in my power, unto the Common Use. Would not Printing in all probability have preserv'd unto us that Vniversal History of Vegetables from the Cedar of *Lebanus* unto the Moss that groweth upon the Wall, written by that Wise and Learned King, and the loss of which we now in vain lament? Would not Printing have sav'd that Excellent Book of *Democritus*, which he inscribed his $\chi\epsilon\iota\rho\acute{o}\varsigma\mu\eta$

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TA OR EXPERIMENTS of his own personal Trial, so utterly lost, that the Name of the piece is not mention'd among the Catalogue of his Writings in *Laertius*? And may not the Printing of this Piece be a meanes of the preservation (besides the Notional part) of divers very useful $\chi\epsilon\iota\pi\omicron'\kappa\mu\eta\tau\alpha$ of the Honorable Author? who hath been ever unwearied in the Tryal of all probable Experiments, that may increase the Light or advance the Profit of Mankind, and whom I may now name to be that most Learned & Noble person Mr. *Boyl*: for the ceasing of certain considerations that before made him willing to have his name suppress'd, and the general very good acceptance of this Discourse have extorted from his Honor that He no longer conceal Himself to be the Author.

But before I leave the Reader, I must give him this single Advertisement, that the Passages included within the *Parabeses* or *Crotchets*, as the Press styles them, that is, between any two such Marks as these [] were inserted long since the writing of these Essays, upon the Relection of some parts of the Book before He sent it to me: which I therefore did so distinguish, and do intimate, that there may appear no inconsistency in our Author, and the Reader may not marvel to find some things very recent in a book written several Years agoe. Farewell.

R O: SHARROCK.



The Author's
ADVERTISEMENT about the following
ESSAYS.



That the Title of the following Treatise might not raise in the Reader an Expectation of more than he will find in the Book, I think my self oblig'd to inform him, That, though it come not forth before, divers parts were sent to the Press in 1660, or 1661 and this present Year 1663, yet the very Last Essay of it was written divers Years before: Since when those Papers were left, sometimes in the hands of Friends, and sometimes in distant places where I could not come at them: which I mention, that the Reader may neither wonder nor blame Me, if he now meet with some things in them that have already been published by others, or are more vulgarly known than my way of mentioning them implies. For it may, this notwithstanding, very well be, that when I writ them, nobody had yet lighted on some of them, and that others of them did then but begin to be

The Authors Advertisement

taken notice of. And as for the Five first Essays, which treat of The Usefulness of Natural Philosophy to the Mind of Man, though by my addressing them all the way to the Gentleman I call Pyrophilus, they may seem to have been Originally written to the same Person, and about the same time with the Essays that make up the Second part; yet indeed a great Portion of the First part was written, as I remember, 10 or 12 years agoe, (when I was scarce above 21 or 22 years old) to another Friend, to whom the Considerations that serv'd to confirm Piety, and excite Devotion, were far more acceptable than those that were more purely Physiological: so that having, whether through Laziness, or want of leisure contented my self to substitute the name of Pyrophilus for that of my other Friend (who was not unwilling I should do so) in a Discourse written when I was so Young, I would not have the Reader think, that I do now so approve of all those youthful Discourses (which I therefore suffer to pass abroad without a Name) as to think all the Tenets they propos'd to be irrefragable Truths, or all the Reasonings they contain, to be Demonstrative; and that I would at present have my Judgment estimated according to their Cogency. But yet I do without much Reluctancy comply with those Friends, who would by no means consent, that the Five first Essays of this Treatise should not come forth with the Rest; partly because not
writing

About the following Essays.

writing all things for all Readers, I hold it not unfit to publish something to gratifie those, who desire with me to be both excited and assisted to admire and praise the Great and Wise Author of all Things; partly because the Treatise would seem maimed and incomplete, if the latter Essays should come abroad without the Rest, and partly too because Learned Men have been pleas'd to assure me, that those Essayes are not destitute of Notions and Ratiocinations, that are not altogether vulgar or contemptible. However those Readers, that either cannot relish, or at least desire not any thing, but what is meerly Physiological, may, thus advertis'd, passe by the former part of this Treatise, and content themselves to read over the Latter, though they who shall take the Pains to read Both, will not perhaps think their Labour lost: since I have taken Care to leave even the former Part as little disfurnisht with Experiments and useful Notions, as, the Argument considered, I conveniently could. And since also for the Paucity of such things in the First Part, I have endeavoured to make amends in the Second, which is almost wholly Physiological; concerning which neverthelesse I shall admonish the Reader: And indeed the whole Tenets that make up the following Book, are by no means to be lookt upon as Published for an accurate Treatise of the Usefulness of true Physiology, but as familiar Writings, that want only the formality of
Salve

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Salve and Vale to passe for *Physiological and Medical Epistles*; consisting of such loose *Observations*, as I thought might be this way preserv'd, and did not so properly belong to my other *Writings* as they seem'd fitted for the use, and whereto I have applied them; namely, that being drawn up together into one *Treatise*, their Union might enable them to make the greater Impression, and might (some what at least) recommend that sort of Learning to a Beginner. And one thing that must be especially comprehended in this Admonition is, that the Particulars I have mentioned, to shew of what use *Chymical Experiments* may be to a *Physitian*, are not, possibly, the chiefest that even I could set down, if I were not restrained by some justifiable Considerations; especially till I see what Entertainment, the things I now adventure abroad, will meet with there: Some of those I reserve, appearing such to me, that I confesse I do not slight them enough to be fond of obtruding them upon the Publick, if I thought they would not be welcom to it. And I do so little desire to have, what I have written, lookt upon as the most that can be said, to shew the Usefulness of *Experimental Philosophy*, that I scruple not to acknowledg there are things which incline me to suspect, that some in the world, though not particularly known to me, may have Arcana, to which most of the Processes I reserve, as well as all that is commonly known in *Chymistry*, may prove little more than Trifles.

OF THE
VSEFULNESSE
OF
Natural Philosophy.

The First Part.

Of its Vsefulness in reference to
the Mind of Man.

ESSAY I.

7



Of the USEFULNESSE of
 EXPERIMENTALL PHILOSOPHY,
 Principally as it Relates to the
 MIND of MAN.



THE NATURAL PHILOSOPHY wont to be taught in most Schools, being little other then a Systeme of the Opinions of *Aristotle*, and some few other Writers, is not, I confesse, *Pyrophilus*, very difficult to be Learned; as being attainable by the perusall of a few of the more Current Authors. But, *Pyrophilus*, that EXPERIMENTALL PHILOSOPHY,

The reason why the Author endeavours to possess Pyrophilus with the true value of Experimentall Philosophy.

which you will find treated of in the following Essayes, is a Study, if duly prosecuted, so difficult, so chargeable, and so toilesome, that I think it requisite, before I propose any particular Subjects to your Enquiries, to possesse you with a just value of true and solid Physiologie; and to convince you, That by endeavouring to addict you to it, I invite you not to mispend your time or trouble on a Science unable to merit and requite it. In order, *Pyrophilus*, to the giving you this satisfaction, Give me leave to mind you, that it was a saying of *Pythagoras*,

B

worthy

worthy so celebrated a Philosopher, That there are two things which most *ennoble* Man, and make him resemble the Gods; *To know the Truth*, and *To do Good*. For *Pyrophilus*, that Diviner part of Man, the Soul, which alone is capable of wearing the Glorious Image of its Author, being endowed with two chief Faculties, the Understanding and the Will; the former is blest and perfectionated by Knowledge, and the latter's Loveliest and most improving property is Goodnesse. A due Reflection upon this excellent Sentence of him to whom Philosophers owe that modest name, should, me thinks, *Pyrophilus*, very much endear to us the Study of Natural Philosophy. For there is no Humane Science that does more gratifie and enrich the Understanding with variety of choyce and acceptable Truths; Nor scarce any that does more enable a willing mind to exercise a Goodnesse beneficiall to others

That Experimental Philosophy is conducive to the improving of Mans Understanding and to the encreasing of Mans power.

To manifest these truths more distinctly, *Pyrophilus*, and yet without exceeding that brevity my Avocations and the Bounds of an Essay exact of me, I shall among the numerous advantages accruing to Men from the Study of the Book of Nature, content my self to instance only in a Couple, that relate more properly to the *Improving of Mens Understandings*, & to mention a few of those many, by which it *encreases their Power*.

The two chief advantages which a reall acquaintance with Nature brings to our Minds, are, First, by instructing our Understandings, and gratifying our Curiosities; and next, by exciting and cherishing our Devotion.

Arguments to prove that Mans Curiosity for knowledge is much thereby gratified.

And for the first of these: since, as *Aristotle* teacheth, and was taught himselfe by common Experience, *all men are Naturally desirous to Know*: that Propensity cannot but be powerfully engaged to the Works of Nature, which being incessantly present to our senses, do continually sollicite our Curiosities: Of whose potent inclining us to the Contemplation of Natures Wonders, it is not perhaps the inconsiderable Instance, that though the Naturall Philosophy hitherto taught in most Schools,

Schools, hath been so Litigious in its Theory, and so barren as to its Productions; yet it hath found numbers of Zealous and Learned Cultivators, whom sure nothing but Mens inbred fondness for the Object it converses with, and the end it pretends to, could so passionately devote to it.

And since that (as the same *Aristotle* taught by his master *Plato* well observes) Admiration is the Parent of Philosophy, by engaging us to enquire into the causes of the things at which we marvel; we cannot but be powerfully invited to the Contemplation of Nature, by living and conversing among Wonders, some of which are obvious and conspicuous enough to amaze even ordinary Beholders; and others admirable and abstruse enough to astonish the most inquisitive Spectators.

The bare prospect of this magnificent Fabrick of the Universe, furnished and adorned with such strange variety of curious and usefull Creatures, would suffice to transport us both with Wonder and Joy, if their Commonness did not hinder their operations. Of which Truth Mr *Stepkins*, the famous Oculist, did not long since supply us with a memorable Instance: For (as both himselfe and an Illustrious Person that was present at the Cure informed mee) a Maid of about Eighteen years of Age, having by a couple of Cataracts, that she brought with her into the World, lived absolutely blind from the moment of her Birth; being brought to the free Use of her Eyes, was so ravish'd at the surprizing spectacle of so many and various Objects, as presented themselves to her unacquainted Sight, that almost every thing she saw transported her with such admiration and delight, that she was in danger to loose the Eyes of her Minde by those of her Body, and expound that Mystickall Arabian Proverb, which advises, *To shut the Windows, that the House may be Light.*

A relation of the transport and surprisall of a maid born blind: when being about 18. yeares old, she obtained the first sight of the various objects of the world instantly presented her with.

But if the bare beholding of this admirable Structure is capable of pleasing men so highly, how much satisfaction, Py-

That the know-
ledge of the in-
ward Archite-
cture, and con-
trivances of
Nature is more
delightfull than
the sight of the
outward shapes.

Pyrophilus, may it be supposed to afford to an Intelligent Spectator, who is able both to understand and to relish the admirable Architecture and skilfull contrivance of it: For the Booke of Nature is to an ordinary Gazer, and a Naturalist, like a rare Book of Hieroglyphicks to a Child, and a Philosopher: the one is sufficiently pleased with the Odneffe and Variety of the Curious Pictures that adorn it; whereas the other is not only delighted with those outward objects that gratifie his sense, but receives a much higher satisfaction in admiring the knowledge of the Author, and in finding out and enriching himselfe with those abstruse and veiled Truths dexterously hinted in them.

Examples and
Instances of the
prevalence of the
pleasure that ar-
ises from the
attainment of
knowledge.

Yes, *Pyrophilus*, as the Understanding is the highest faculty in Man, so its Pleasures are the highest he can naturally receive. And therefore I cannot much wonder that the famous *Archimedes* lighting in a Bath upon an Expedient to resolve a perplexing difficulty in Naturall Philosophy, should leap out of the Bath, and run unclothed like a madman, crying nothing but *Ευρηκα*, *Eureka*, I have found it, I have found it. Nor do I so much admire as deplore the fatally venturous curiosity of the Elder *Pliny*, who, as the Younger relates, could not be deterr'd by the formidable-nesse of destructive flames vomited by *Vesuvius*, from endeavouring by their Light to read the Nature of such Vulcanian Hills; but in spite of all the dissuasions of his Friends, and the affrighting eruptions of that hideous Place, he resolved that Flaming Wonder should rather kill him, then escape him; and thereupon approached so neer that he lost his Life to satisfie his Curiosity, and fell (if I may so speak) a Martyr to Physiologie. For we daily see Alchymists hazard their lives on Minerall Experiments in Furnaces, where though the fires are not so vast and fierce, as those that *Pliny* went to consider, yet the (dangerous when not pernicious) Fumes do sometimes prove as fatall.

One would think, *Pyrophilus*, that the conversing with dead and stinking Carcasses (that are not only hideous objects in themselves, but made more ghastly by putting us in mind that our selves must be such) should be not only a very melancholy, but a very hated imployment. And yet, *Pyrophilus*, there are Anatomists who dore upon it; And I confesse its Instructivenesse hath not onely so reconciled me to it, but so enamor'd me of it, that I have often spent houres much lesse delightfully, not onely in Courts, but even in Libraries, then in tracing in those forsaken Mansions, the inimitable Workmanship of the Omniscient Architect.

The curious Works of famous Artificers, are wont to invite the Visits, and excite the wonder of the generality of inquisitive Persons. And I remember, that in my Travels, I have often taken no small pains to obtain the pleasure of gazing upon some Masterpiece of Art: But now, I confess, I could with more delight look upon a skilfull Dissection, then the famous Clock at *Strasburg*. And, methinkes, *Aristotle* discourseth very Philosophically in that place, where passing from the consideration of the sublimest productions of Nature, to justifie his deligence in recording the more homely Circumstances of the History of Animals, he thus discourseth: *Restat (saith he) ut de animanti natura differamus, nihil pro viribus omittentes vel vilius vel nobilius. Nam & in iis quæ hoc in genere minus grata nostro occurrunt sensui, Natura parens & author omnium miras excitat voluptates hominibus, qui intelligunt causas & ingenudè Philosophantur. Absurdum enim nulla ratione probandum est, si imagines quidem rerum naturalium non sine delectatione propterea inspectamus, quod ingenium contemplanur quod illas considerit, id est, artem pingendi aut fingendi; rerum autem ipsarum natura ingenio miræque solertia constitutam contemplationem non magis prosequamur atque excoleretur, modo causas perspicere valeamus: It remains (saith he) that we discourse of the natures of Animals, being circumspect*

That the knowledge of the most curious Artificiall works is not more delightful then the knowledge of Naturall.

Aristide Part: Animal lib. 1. c. 5

to omit none either of the nobler or inferiour sort: For even from those Creatures which lesse please our sense, does the universal Parent, Nature, afford incredible contentments to such Persons, as understand their causes, and Philophize ingeniously. Since it were absurd and inconsistent to reason, if we should behold the Portraiture of Natural things with delectation, because we observe the accurateness wherewith they are designed, namely, the skill of Painture or Sculpture; and not much more affect and pursue the contemplation of things themselves, contrived by the exquisite Artifice and Sagacity of Nature, provided we be able to understand their causes. And the better to make out to you, Pyrophilus, the delightfulnesse of the study of Natural Philosophy, let me observe to you, That those pleasing Truths it teacheth us, do highly gratifie our intellectual Faculties, without displeasing any of them: for they are none of those Criminal Pleasures, which injur'd and incens'd Conscience does very much allay, even in the Fruition, and turns into Torments after it. Nor are the Enquiries I am recommending of that trifling and unserviceable sort of Employments, which though Conscience condemnes not as unlawful for a Christian, Reason disapproves as not worthy of a Philosopher; and wherewith to be much delighted, argues a weaknesse; as to be pleased with Babies and Whistles, supposes unripe and weak Intellectuals: But the contemplation of Nature, is an Employment, which both the Possessors of the sublimest Reason, and those of the severest Virtue, have not onely allowed, but cultivated. The Learned Author of the Book *De Mundo*, ascrib'd to Aristotle, begins it with this *Elogium* of Natural Philosophy: *Mihi quidem saepe (sayes he) divina quadam res, Alexander, admiratione digna visa est Philosophia; praeipue vero in ea parte in qua sola ipsa sublimè sese tollens ad contemplandas rerum naturas magno illic studio contendit existentem in eis veritatem pernoscere. Philosophie (sayes he) O Alexander, hath oftentimes seem'd to me a Divine and Admirable Thing; but chiefly*

That the delight
herein is alto-
gether inoffen-
sive.

Instances of the
Esteeme diverse
ancient Philoso-
phers had for it.

chiefly, that part of it, which aspires to contemplate the Natures of things, employing its utmost power in searching out the truth contained in them. The reasonableness of which Commendation, he handsomely enough prosecutes in the subsequent discourse: To which I shall refer you, that I may proceed to minde you, that *Pythagoras, Democritus, Plato*, and divers others of those whose Wisdom made after-ages reverence Antiquity, did not onely esteem the Truths of Nature worth studying for, but thought them too worth Travelling for as far as those Eastern Regions, whose Wise-men were then cry'd up for the best Expositors of the obscure Booke of Nature. And that severe Teacher, and perswasive Recommender of the strictest Virtue, *Seneca* (whose eminent Wisdom made him invited to govern Him that was to govern the World, and who so often and so excellently presses the husbanding of our time) does not only in severall passages of his Writings praise a contemplation of Nature, but Writes himselfe seven Bookes of Naturall Questions, and addressees them to that very *Lucilius*, whom in his Epistle he takes such pains to make compleatly Virtuous, and in his Preface, after he had said according to his manner, loftily, *Equidem tunc Natura rerum gratias ago, cum illam non ab hac parte video, qua publica est, sed cum secretiora ejus intravi, cum disco quæ Universi Materia sit, quis Author, aut Custos, &c.* Then do I pay my acknowledgements to Nature, when I behold her not on the out-side, which is obvious to publick view, but am enter'd into her more secret Recefes: when I understand what the Matter of the Universe is, who its Author, and Preserver, &c. He concludes in the same strain, *Nisi ad hæc admitterer, non fuerat opera pretium nasci: Had I been debarr'd from these things, it would not have been worth coming into the World.* And to adde what he excellently sayes in another Treatise, *Ad hæc querenda natus* (says he, having spoken of Enquiries concerning the Universe) *astima quàm non multum acceperis temporis, etiam si illud totum sibi vindicet, cui licet*

*Seneca in Pref.
lib. 1. Nat.
Quæst.*

licet nihil facilitate eripi, nihil negligentia patiatur excidere; licet horas suas avarissimè servet, & usque in ultima etatis humana terminos procedat; nec quicquid illi ex eo quod Natura constituit fortuna concutiat; tamen homo ad immortalium cognitionem nimis mortalis est. Ergo secundum Naturam vivo, si totum me illi dedi, si illius Admirator Cultorq; sum. Natura autem utrumq; facere me voluit & agere, & contemplationi vscare: Being born designedly for searching out these things, consider that the portion of time allotted to Man, is not great, if this Study should ingross it all; since though he should preserve his hours with the greatest frugality all his life time, not suffering any to be stolen from him, or slide away negligently, and never be disturbed by Accidents of Fortune in the Employment Nature has appointed him, yet is he too Mortal to attain the knowledge of Immortal Things. Wherefore, I live agreeable to Nature, when I give up my self wholly to Her; and am Her Admirer and Adorer. Moreover, Nature hath designed me to act, and employ my self in Contemplation. How far Religion is from disapproving the Study of Physiology, I shall have occasion to manifest ere long, when we shall come to shew, That it is an act of Piety to offer up for the Creatures the Sacrifice of praise to the Creator; For, as anciently among the Jewes, by vertue of an Aaronical Extraction, Men were borne with a Right to Priesthood; so Reason is a Natural Dignity, and Knowledge a Prerogative, that can confer a Priesthood without Unction or imposition of Hands. And as for Reason, that is so far from making us judge that Employment unworthy of Rational Creatures, that those Philosophers (as Aristotle, Epicurus, Democritus, &c.) that have improv'd Reason to the greatest height, have the most seriously and industriously employ'd it to investigate the Truths, and promote the study of Natural Philosophy.

And indeed, that noble Faculty call'd Reason, being conscious of the great progress it may enable us to make in the knowledge

a
Sen. de Otio
Sap. 6. 32

How this Study
consists with
Religion.

knowledge of Natures Mysteries, if it were industriously im-
 ployed in the study of them, cannot, but like a great Com-
 mander, think it self disobliged by not being considerably em-
 ployed. And certainly we are wanting to our selves, and are
 guilty of little lesse than our own Degradation, that being by
 God's peculiar vouchsafement, endowed with those noble Fa-
 culties of Understanding, and Discourfing, and plac'd amidft
 a numberlesse variety of Objects, that incessantly invite our
 Contemplations, can content our selves to behold so many
 Instructive Creatures which make up this vast Universe, whose
 noblest part we are designed to be, with no more, or but lit-
 tle more discerning Eyes than those less favoured Animals, to
 whom Nature hath denied the Prerogative of Reason, as we
 deny our selves the use of it. *Aristotle* well observes, that
 among Animals, Man alone is of an erected Stature; and adds,
 That it is because his Nature hath something in it of Divine:
officium autem Divini (inters he) *est intelligere atq; sapere:*
The Qualifications of a Divine Being, are Understanding and
Wisdom. And it cannot but mis-become the dignity of such a
 Creature to live Ignorant or Unstudious of the Laws and Con-
 stitutions of that great Commonwealth (as divers of the An-
 cients have not improperly stiled the World) whereof he is
 the eminentest part. And were we not lulled asleep by Custom
 or Sensuality, it could not but Trouble, as well as it Injures a
 reasonable Soul to Ignore the Structure and Contrivance of
 that admirably Organiz'd Body in which she lives, and to
 whose intervention she owes the Knowledge she hath of other
 Creatures.

Tis true indeed, that even the generality of Men, without
 making it their design, know somewhat more of the Works
 of Nature, than Creatures destitute of Reason, can, by the
 advantage of that Superior Faculty, which cannot but even
 unpurg'd, and of its own accord make some, though but slight,
 reflections on the Information of the Senses: But if those im-
 pressions be onely receiv'd and not improv'd, but rather neg-
 lected;

*The absurdity of
 not employing hu-
 mane faculties on
 the contemplati-
 on of those Ob-
 jects to which
 they are fitted.*

De part. Anim.
lib. 4 c. 10.

Illustrated by the
Similitude of a
Spider in a Pa-
lace, taking no-
tice of nothing
beside her own
Cobweb.

lected; and if we (contenting our selves with the superficial account given us of things by their obvious Appearances and Qualities) are beholding for that we know, to our Nature, not our Industrie, we faultily loose both one of the noblest Imploiments, and one of the highest Satisfactions of our rational Faculty. And he that is this way wanting to himself, seems to live in this magnificent Structure, call'd the Universe, not unlike a Spider in a Palace; who taking notice onely of those Objects that obtrude themselves upon her Senses, lives ignorant of all the other Rooms in the House, save that wherein she lurks; and discerning nothing either of the Architecture of the stately Building, or of the Proportion of the parts of it in relation to each other, and to the entire Structure, makes it her whole businesse, by intrapping of Flies, to continue an uselesse Life; or exercise her self to spin Cob-webs, which though consisting of very subtle Threeds, are unserviceable for any other then her own trifling Uses. And that the contemplation of the World, especially the higher Region of it, was design'd for Man's Imploiment by Natures Self, even the Heathen Poet (perhaps instructed by Aristotle) could observe, who sings,

*Pronaq; cum spectent Animalia cætera terram,
Os homini sublime dedit, cælumq; tueri
Fussit, & erectos ad sidera tollere vultus.*

*Wise Nature, framing Bruiis with downward looks,
Man with a lofty Aspect did endue,
And bad him Heaven with its bright Glories view.*

The opinion that
Ovid, Seth, A-
braham, and So-
lomon had of
Mans fitness for
the Study of A-

I might annex, Pyrophilus, the Story Josephus tells us in the beginning of his *Jewish Antiquities*, that twas the holy Seth and his Posterity (who are in *Genesis* stil'd the Sons of God) that were the Inventers of Astronomie, whose more Fundamental Observations (to perpetuate them to Mankind, and
sever

sever them from the foretold destructions by Fire and Water) they engraved upon two Pillars, the one of Brick, the other of Stone; the latter of which our Historian reports to have been extant in Syria in his time. And it is an almost uncontroll'd tradition, that the Patriarch, whom God vouchsafes to stile *his Friend*, was the first teacher of Astronomy and Philosophie to the *Egyptians*, from whom, long afterwards, the *Grecians* learn'd them. *Berosus* himself records him to have been skill'd in the Science of the Stars, as he is cited by *Josephus*, (*Ant. lib. 1. c. 8.*) who a litle after speaking of *Abraham* and the *Egyptians*, expressly affirms, that *Numerorum scientiam & siderum benignè illis communicavit: Nam ante Abrahami ad se adventum, Egyptii rudes erant hujusmodi disciplinarum; quæ à Chaldeis ad Egyptios profectæ, hinc ad Græcos tandem pervenerunt.*

Astronomy and other Physiology.

*Isaiah 41. 8.
James 11. 23.*

But, *Pyrophilus*, to put it out of question that the sublimest reason needs not make the Possessor of it think the Study of Physiologie an employment below him, that Unequall'd *Solomon*, who was pronounced the Wisest of men by their omniscient Author, did not onely Justifie the study of Natural Philosophie by addicting himself to it, but ennobled it by teaching it, and purposely composing of it those matchlesse Records of Nature, from which I remember some Jewish Authors relate *Aristotle* to have borrowed diverse; which (if it be true) may well be supposed to be the choicest pieces that adorned his Philosophie, and which Providence perhaps depriv'd the World of, upon such a score as it did the Jews of the Body of *Moses*, lest men should Idolize it, or, as some Rabbies are pleas'd to inform us, lest vicious men should venture upon all kinds of Intemperance, out of Confidence of finding out by the help of those excellent Writings the Cure of all the distempers their dissoluteness should produce.

Why Providence might deprive us of Solomon's Physiology.

And, *Pyrophilus*, yet a litle further to discover to You the Delightfulness of the Contemplations of Natures workes, Give me leave to mind You of their almost unimaginable Variety

riety, as of a Propertie that should me thinks not faintly recommend Natural Philosophy to curious and active Intellectuals.

Of the delight
that may arise
from the variety
of objects which
Nature produces

For most other Sciences, at least as they are wont to be taught, are so narrow and so circumscrib'd, that he who has read one of the best and recentest Systems of them, shall find little in the other Books publisht on those subjects, but disguis'd repetitions; and a diligent Scholar may in no long time learn as much as the Professors themselves can teach him. But the objects of Natural Philosophy, being as many as the Laws and works of Nature are, so various and so numberlesse, that if a man had the Age of *Methuselah* to spend, he might sooner want Time than Matter, for his Contemplations: and so pregnant is each of that vast multitude of Creatures, that make up the Naturalists Theme, with useful matter to employ Mens studie, that I dare say, that the whole life of a Philosopher spent in that alone, would be too short to give a full and perfect account of the Natural Properties and Uses of any one of several Minerals, Plants, or Animals that I could name. 'Tis an almost incredible variety of Vegetables, that the teeming Earth, impregnated by God's *Pro- ducat Terra*, does in several Regions produce. Botanists have a pretty while since, reckon'd up neer 6000 Subjects of the Vegetable Kingdom; since when, divers other not described Plants have been observed by Herbarists, the chief of which will, I hope, be shortly communicated to the World, by that Curious and Diligent Botanist my industrious Acquaintance, Dr. *How*, to whom I not long since presented a peculiar and excellent kind of Pepper, whose Shell tastes not unlike Cinnamon, and smells so like Cloves, that with the Odour I have deceived many, which he confest to be new even to him; it having been lately gathered in *Jamaica* (where it abounds) and presented me by the inquisitive Commander of the English Forces there. And yet, *Pyrophilus*, this great variety of Simples could not deter either Ancient or Modern Inquirers from writing

That there be a-
bove 6000 sub-
jects of the ve-
getable King-
dom.

Of an excellent
Jamaica Pepper
newly brought o-
ver.

witing entire Treatises of some particular Ones. So *Pliny* tells us,^a That *Themison* the Physician publisht a Volume (for so he call'd it) of that vulgar and despised Herb called *Plantain*. So the same^b Author tells us, That *Amphilochus* writ a Volume *De Medica Herba*, & *Cytisa*: and King^c *Juba* another, of a sort of *Nymphaea* by him found on Mount *Atlas*. And in our Times, not to mention those many Books that have been written by Physicians, of the structure of Mans Body, and *De Usu partium*, *Carolus Rosenbergius* writ some Years since an entire Book of *Roses*, which he calls his *Rhodologia*: *Martinus Blochwitzius* since published another Book of *Elder*, under the Title of *Anatomia Sambuci*. Among the Chymists, *Angelus Sala* published in distinct Treatises his *Vitriologia*, *Tartarologia*, *Saccharologia*. *Untzerus* also writ peculiar Tracts *De Mercurio*, *De Sulphure*, *De Sale*. And *Paracelsus* himself vouchsafed distinct Treatises to *Hypericon*, *Perficaria*, *Helleborus*, and some other particular Plants. *Basilus Valentinus* (one of the most knowing and Candid Chymical Writers) publisht long since an excellent Treatise of *Antimony*, inscrib'd *Curus Triumphalis Antimonii*; but though in his other he hath also taught us diverse other things concerning it, yet he left so much undiscovered in *Antimony*, that *Angelus Sala* was thereby emboldned to publish his *Anatomia Antimonii*. And *Hamerus Poppius* (if that be his true name,) *Johannis Tholdius*, and the Experienced *Alexander Van Suchten*, thought fit to write entire Treatises of that same Mineral; by which if they seem to Eclipse the diligence of *Basilus*, at least they bore witness to his Judgment: for modestly inviting his Readers to make further Enquiries into the Nature and Preparations of that abstruse Mineral, he gives this account of his leaving many things unmentioned, *That the shortnesse of Life makes it impossible for one man thoroughly to learn Antimony, in which every day something of new is discovered*. And I remember, that having lately given a Chymist, upon his request, some Directions for drawing, not an imaginary Mer-

cury

Of divers single subjects that require large treatises to unfold them.

a Plin. lib. 25.

cap. 8.

b Id. lib. 28.

cap. 26.

c Id. lib. 25.

c. 7.

How many treatises are already made of Antimony, which yet has not been perfectly discovered.

Of a real Mercury of Antimony.

And a real combustible Sulphur of Antimony that burns like ordinary brimstone.

A new Tincture of Antimonial Glass, with the entire process to draw it.

cury of Antimonie, as those which are wont to be taught by Chymists, but a real fluid Quick-silver, he some dayes since brought me about an Ounce of it (which You may command when You please) as the first Fruits of Directions, differing enough from those which I have hitherto met with in Authors. A peculiar way likewise of separating from Antimony, not such a Substance as those which are as improperly as vulgarly call'd Antimonial Sulphurs, but a really combustible Body, which looks and burns so like common Brimstone, that it is not easily distinguishable from it, we shall elsewhere, God willing, *Pyrophilus*, teach You. And I remember, that whereas according to the way mentioned by *Basilus* in his *Currus Triumphalis*, and both generally transcrib'd by Authors, and formerly practis'd by our selves, the Tincture of the Glasse of Antimonie is very tedious to make, being to be drawn with Spirit of Vinegar, I once made a *Menstruum* to draw it more expeditiously, which having not hitherto met with in any of the Authors I have read, I shall not conceal from You. Taking then an arbitrary quantity of the best French Verdegrece, and distilling it orderly in a strong naked Fire, I found the extorted Liquor to extract (even in an ordinary digesting heat) from powdered Antimonial Glass, a Bloud-red Tincture in three or four hours, and my Curiosity leading me to abstract the *Menstruum* from the tinging Powder, and put it again upon pulveriz'd Glass, I found it again highly tincted in very few hours. And prosecuting the Experiment, I found that by drawing off the *Menstruum*, and digesting Spirit of Wine upon the remaining *Calx*, I could soon obtain a red Tincture, or Solution; from which some Chymists, if I should tell them what I have now told You, would perhaps expect no ordinary Medicine. But this, I suppose, you will think lesse strange, than that with a Liquor easily separated, by a way which I may elsewhere teach You, from an obvious Vegetable, of which You may safely eat a whole Pound at a Time, I have drawn a deep red Tincture, even from crude Antimony, and that in not many hours, and without heat.

And

And to these Experiments of Antimony, I might (partly from the communication of my Friends, and partly from some trials of my own) adde divers other undivulg'd Experiments relating to that Mineral, if it were not now more seasonable, reserving them for other Papers, to mind You, That the Learned *Kircherus* hath enricht us with a great Volume in *Folio*, of Light and Shadows; and another in *Quarto*, of the Load-stone: and yet none of these have so exhausted the Subjects they have treated of, but that an after-Enquirer may be able to recruit their Observations with many new ones, perhaps more numerous or more considerable than the former: As after our Learned Country-man *Gilbertus* had written a Volume of the Load-stone, the Jesuite *Cabeus* was not by that deterr'd from writing another of the same Subject: And though since *Cabeus*, the Ingenious *Kircherus* have so largely prosecuted it in his Voluminous *Ars Magnetica*, yet he has not reap'd his Field so clean, but that a careful Gleaner may still find Ears enough to make some Sheaves. And what I have lately tried or seen, makes me think it very possible to recruit those many of *Kircherus*, with some further Magnetical Experiments unmentioned in his Book. And I have, the very day I writ this, made in that admirable Stone a not-inconsiderable Experiment, not extant (that I remember) there: For taking an oblong Load-stone, and heating it red-hot, I found the attractive Facultie in not many Minutes, either altogether abolish'd, or at least so impaired and weakned, that I was scarce, if at all, able to discern it. But this hath been observed, though not so faithfully related; by more than one, wherefore I shall adde, That by refrigerating this red-hot Loadstone either North or South, I found that I could give its Extreame a Polarity (if I may so speak) which they would readily display upon an excited Needle freely plac'd in *Aequilibrium*: And not only so, but I could by refrigerating the same end sometime North, and sometime South, in a very short time change the Poles of the Load-stone at pleasure, making that which was a Quarter of

Of *Gilbertus*,
Cabeus, and
Kircher, who
successively writ
the Experiments
of the Load-stone

Of some new
Experiments hi-
therto undisco-
ver'd of that
Stone.

an hour before the North-pole, become the South; and on the contrary, the formerly Southern Pole become the Northern. And this change was wrought on the Load-stone, not onely by cooling it directly North and South, but by cooling it perpendicularly; that end of it which was contiguous to the Ground growing the Northern Pole, and so (according to the Laws Magnetical) drawing to it the South end of the Needle, and that which was remotest from it, the contrary one: As if indeed the Terrestial Globe were, as some Magnetick Philosophers have suppos'd it, but a Great *Magnes*, since its Effluvioms are able, in some Cases, to impart a Magnetick Faculty to the Loadstone it self. Some other Experiments of this nature, not extant in *Kircherus*, we may have elsewhere fit opportunity to mention. And indeed, that Ænigmatical Mineral (if I may so call it) the Load-stone, is a subject so fertile in Rarities, that I hear, he himself is Re-printing that accurate Treatise, with new and large Additions.

That admirab'e
Speculations may
arise from the
most despicab'e
productions of
Nature.

Nor are the smallest and most despicable productions of Nature so barren, but that they are capable both to invite our Speculations, and to recompense them. *Pliny* in the eleventh Book of his Natural History, where he treats of Insects, is a little after the entrance, transported with an unwonted admiration of the Workmanship of Nature in them: *Nusquam alibi* (sayes he) *spectatiore Natura rerum artificio: In nothing elsewhere* (saith he) *is the workmanship of Nature more remarkable than in the contexture of these little Creatures.* And after a Wonder, not unworthy a Philosopher, he concludes, *Rerum Natura nusquam magis quam in minimis tota est: Nature in her whole Power is never more wholly seen than in her smallest works.* To which *Epiphonema* he addes this sober and Philosophical Admonition: *Quapropter, quasone hac legentes, quoniam ex his spernunt multa, etiam relata fastidio damnant, cum in contemplatione Natura nihil possit videri supervacaneum: Wherefore I would request the Perusers of these Discourses, that although*

though the subjects we treat of are contemptible in their eyes, they would not therefore disdain the relations we shall make of them; since nothing ought to seem superfluous in the contemplation of Nature. I remember that it is from the consideration of so despicable a part as the skin of the Sole of the Foot, that Galen takes occasion to magnifie the Wisdom of God in those excellent terms that we shall have occasion to mention hereafter. And, as he says rarely well, though some Creatures seem made of much coarser Stuff then others, yet even in the vilest the Makers Art Shines through the despicableness of the Matter. For Idiots admire in things the Beauty of their Materials, but Artists that of the Workmanship. to which after a great deal of Philosophicall discourse, he adds, *Neque oculo nec cerebro deterius est pes constructus, si utraq; pars ad actiones, cuius gratia fuit facta, se habeat optimè; neq; cerebrum sine pede se probe haberet, neque pes sine cerebro: Eget enim, opinor, illud vehiculo, hic autem sensu:* Nor is the Foot worse contriv'd then the Brain or Eye, provided each part be duly dispos'd for the performance of the actions to which it was design'd: Since the Brain could not conveniently want the Foot, nor the Foot the Brain. For, I conceive, that one stands in need of a support for local motion, and the other of a source from whence to derive the faculties of Feeling. To which we may annex that Judicious reasoning of Aristotle, who descending from the contemplation of the sublimer Works of Nature, to treat of the Parts of Animals, thus endeavors to keep his Readers from thinking that the Object of it must render that Enquiry despicable: *Restat* (says he) *ut de animanti Natura disseramus:* And having set down those Words which you have not long since read in connection to these, he thus prosecutes his discourse: *Quamobrem, viliorum animalium disputationem perpen- sionemq; fastidio quodam puerili sprevisse, molesteq; tulisse dignum nequaquam est: Cum nulla res sit Natura, in qua non mirandum aliquod habeatur. Et quod Heraclitum ferunt dixisse ad eos, qui cum alloqui eum vellent, quòd fortè in Casa furnaria quadam caloris gratia sedentem viderent, accedere temperarunt, ingredi enim*

*enim eos fidenter iussit; Quoniam, inquit, ne huic quidem loco Dii desunt immortales; Hoc idem in indaganda quoq; natura animantium faciendum est. Aggredi enim quaque sine ullo pudore debemus; cum in omnibus Natura numen, & honestum pulchrumq; insit Ingenium: Wherefore it is altogether unseemly to reject with a kind of Childish nicitie, or be offended at the Discourse and Speculation of inferior Animals; Since there is nothing in all Nature, but contains in it somewhat worthy of Admiration. And as it is recorded of Heraclitus, that seeing some persons desirous to speak with him, refused to approach towards him, because they beheld him warming himself in a miserable Cottage, he bad them come in without scruple, since here also (saith he) are the Immortal Gods present: So in like manner ought we to be highly perswaded of the Dignity of Animals, when we make Enquiries into their Natures. Which we ought in no wise to beasham'd of; since the mighty Power and laudable Wisdom of Nature is conspicuous in all things. Nay Paracelsus himself, as haughty as he was, was Philosopher enough not to disdain to write a Book *De Mysteriis Vermium*; wherein, though according to His manner he hath set down many extravagances, he is more Candid in the Delivery of severall Remedies (which Experience hath recently taught us to be more effectually then probable) then in most other of his Writings: And in that Treatise he justly reprehends the Laziness and Pride of those Physitians, who not only neglect and scorn Enquiries of Nature themselves: but when the fruits of such Enquiries are presented them by others, instead of a gratefull acceptance, receive them with contempt and derision. To which a while after he adds, what is most true, *That God hath Created nothing so vile, despicable, abject, or filthy in the World, that may not make for the health and Use of Man.* And certainly what ever God himselfe has been pleased to think worthy his Making, its Fellow-creature, Man, should not think unworthy of his Knowing. Nor is it a disparagement to a Humane Notion, to represent a Creature, which has the Honour to have been framed according to a Divine Idea: and therefore the wisest of Men in His*

Naturall

what ever God
has thought worthy
of making,
man should not
think unworthy
of knowing.

Natural History, scruples not to write as well of abject *Reptils* as of *Lions*, *Eagles*, *Elephants*, and other Noble Animals: and did not only Treat of the tall Cedars of *Lebanon*, but that despicable Plant (what ever it be that is designed by the Hebrew *Ezob*) which growes out of the Wall. For my part, If I durst thinke my Actions fit to be Examples, I should tell you, that I have been so far from that effeminate squeemishnesse, that one of the *philosophicall Treatises*, for which I have been gathering Experiments, is of the Nature and Use of Dunges. And though my condition does (God be praised) enable me to make Experiments by others Hands; Yet I have not been so nice as to decline dissecting *Dogs*, *Wolves*, *Fishes*, and even *Rats* and *Mice*, with my owne Hands. Nor when I am in my Laboratory do I scruple with them naked to handle Lute and Charcoale.

I should here, *Pyrophilus*, cease to entertain you with Discourses of the pleasantnesse of Natural Philosophy, but that I remember I have not yet told you, that the study of Physiologie is not only delightful, as it teaches us to Know Nature, but also as it teaches us in many Cases to Master & Command her. For the true Naturalist (as we shall see hereafter) does not only Know many things, which other men Ignore, but can perform many things which other men cannot Doe; being enabled by his skill not barely to understand severall Wonders of Nature, but also partly to imitate, and partly to multiply and improve them. And how naturally we affect the Exercise of this Power over the creatures may appear in the delight children take to do many things (which we may have occasion to mention elsewhere) that seem to proceed from an Innate Propensity to please themselves in imitating or changing the Productions of Nature.

And sure 'tis a great Honour that the Indulgent Creator vouchsafes to Naturalists, that though he gives them not the power to produce one Atome of Matter, yet he allows them the power to introduce so many Formes (which Philosophers teach to be nobler then Matter) and work such changes among the Creatures, that if *Adam* were now alive, and should Survey

Of the Dominion and Power that Physiologie gives the most voracious Students of it.

that great Variety of Man's Productions, that is to be found in the shops of Artificers, the Laboratories of Chymists, & other well-furnished Magazines of Art, he would admire to see what a new world, as it were, or set of Things has been added to the Primitive Creatures by the Industry of his Posterity.

And though it be very true, that man is but the Minister of Nature, and can but duely apply Agents to Patients (the rest of the Work being done by the applyed Bodies themselves) yet by his skill in making those Applications, he is able to perform such things as do not only give him a Power to Master Creatures otherwise much stronger then himselfe, but may enable one man to do such wonders, as another man shall think he cannot sufficiently admire. As the poor Indians lookt upō the Spaniards as more then Men, because the knowledg they had of the Properties of Nitre, Sulphur and Charcoale duely mixt, enabled them to Thunder and Lighten so fatally, when they pleased. And this Empire of Man, as a Naturalist, over the Creatures may perchance be to a Philosophical Soul preserved by reason untainted with Vulgar Opinions, of a much more satisfactory kind of Power or Sovereignty then that for which ambitious Mortals are wont to bloodily contend. For oftentimes this Latter being commonly but the Gift of Nature, or Present of Fortune, and but too often the Acquist of Crimes, does no more argue any true worth or noble superiority in the possessor of it, then it argues one Brasse Counter to be of a better Metal than its Fellows, in that it is chosen out to stand in the Account for many Thousand Pounds more then any of them. Whereas the Dominion that Physiologie gives the Prosperous Studier of it (besides that it is wont to be innocently acquired, by being the Effect of his knowledge) is a Power that becomes Man as Man. And to an ingenious spirit, the Wonders he performs bring perchance a higher satisfaction, as they are Proofes of his Knowledge, then as they are Productions of his Power, or even bring Accessions to his Store.



ESSAY II.

OF THE SAME.

THe next Advantage, *Pyrophilus*, that we mention'd That the know-
ledge of Nature
excites and che-
rishes devotion.
 the Knowledge of Nature to bring to the Minds of
 Men, is, That therein it excites and cherishes Devo-
 tion; Which when I say, *Pyroph.* I forget not that there
 are severall Divines (and some of them Eminent ones) that
 out of a Holy Jealousie (as they think) for Religion, labour
 to deterre men from addicting themselves to serious and tho-
 rough Enquiries into Nature , as from a Study unsafe for a
 Christian, and likely to end in Atheisme , by making it possi-
 ble for Men (that I may propose to you their Objection as
 much to its Advantage as I can) to give themselves such an
 Account of all the Wonders of Nature, by the single Know-
 ledge of Second Causes, as may bring them to disbelieve the
 Necessity of a First. And certainly, *Pyrophilus*, if this Ap-
 prehension were well grounded, I should think the threat-
 ned Evill so considerable, that instead of inviting you to the
 Study of Naturall Philosophy , I should very earnestly La-
 bour to dissuade you from it. For I, that had much rather
 have Men not Philosophers then not Christians , should be
 better content to see you ignore the Mysteries of Nature then
 deny the Author of it. But though the Zeal of their Inten-
 tions keep Me from harbouring any unfavourable Opinion
 of the Persons of these Men, yet the Prejudice that might re-
 dound from their Doctrine (if generally received) both to
 the Glory of God from the Creatures, and to the Empire of
Man

Man over them, forbids Me to leave their opinion unanswer'd; though I am Sorry that the Necessity of Vindicating the Study I recommend to You from so heinous a crime as they have accus'd it of, will compel me to Theologize in a Philosophical Discourse: which that I may do, with as much Brevity as the Weight and Exigency of my Subject will permit, I shall Content my selfe onely in the Explication of my own Thoughts, to hint to you the grounds of Answering what is alledg'd against them.

*The Ends of
Gods Creation:
his own Glory.
Job. 8. 9.*

And first, *Pyrophilus*, I must premise, That though it may be a Presumption in Man, (who to use a Scripture Expression, *Is but of Yesterday, and knows Nothing, because his Dayes upon the Earth are but as a shadow*) precisely and peremptorily to define all the Ends and Aimes of the Omniscient God in His Great Work of the Creation; Yet, perhaps, it will be no great venture to suppose that at least in the Creating of the Sublunary World, and the more conspicuous Stars, two of God's Principal ends were, the Manifestation of His own Glory, and the Good of Men. For the First of these; *The Lord hath made all things for himselfe*, saies the Preacher; *For of Him, and through Him, and to Him, are all things*, saies the Apostle. And, *Thou hast Created all things, and for Thy Pleasure they are and were Created*, say the twenty four Prostrate Elders (Representatives, perhaps, of the whole Church of both Testaments, propagated by the Twelve Patriarchs, and the like number of Apostles) to their Creatour, which Truth, were it requisite, might be further confirmed by several other Texts, which to decline needlesse prolixity, I here forbear to insist on. Consonantly to this we hear the Psalmist Proclaiming that *The Heavens Declare the Glory of God, and the Firmament sheweth his Handy Workes*. To which purpose we may also observe, that though Man were not Created till the close of the Sixth Day (the Resident's Arrivall being Obligingly Suspended till the Palace was made ready to entertain Him) yet that none of God's works might want Intelligent Spectators and Admirers

Prov. 16. 4.

Rom. 11. 36.

Psal. 19. 1.

mirers, the Angels were Created the First Day, as Divines generally infer from the Words of God in *Job*; *Where wast thou when I laid the Foundations of the Earth?* and a little after: *When the Morning Stars sang together, and all the Sons of God shouted for Joy.* Where by the *Morning Stars* and *Sons of God* are suppos'd to be meant the newly Created Angels; one of whose earliest exercises was, it seems, to applaud the Creation, and take thence occasion to sing Hymnes to the Almighty Author of it. I should not, *Pyrophilus*, adde any thing further on this subject, but that having since the writing of these thoughts met with a Discourse of *Seneca's*, very consonant to some of them, I suppose it may tend to your delight as well as to their advantage, if I present you some of the Truths you have seen in my courser Language, dress'd up in his finer and happier Expressions. *Curiosum nobis* (saith he) *natura* Sen. de Otio Sap. 32.

ingenium dedit, & artis sibi pulchritudinisq; conscia spectatores nos tantis rerum spectaculis genuit, perditura factum sui, sitam magna, tam clara tam subtiliter ducta, tam nitida & non uno genere formosa solitudini ostenderet; Ut scias illam spectari voluisse, non tantum aspicere, vide quem locum nobis dedit, nec e-rexit tantummodo hominem, sed etiam ad contemplationem factum, ut ab ortu sidera in occasum labentia prosequi posset & vultum suum circumferre cum toto, Sublime illi fecit caput, & collo flexibili imposuit. Deinde sena per diem, sena per noctem signa produxit; nullam non partem sui explicuit, ut per hac qua obtulerat ejus oculis cupiditatem faceret etiam caterorum: nec enim omnia nec tanta visimus quanta sunt, sed acies nostra aperit sibi investigando viam, & fundamenta veri jact, ut inquisitio transeat ex apertis in obscura, & aliquid ipso Mundo inveniat Antiquius. And least you might be offended at his mentioning of Nature, and silence of God, give me leave to inform you, that about the close of the Chapter immediately preceding that, whence the Passage you come from Reading is transcrib'd, having spoken of the Enquiries of Philosophers into the Nature of the Universe, he adds, *Hec qui contemplatur,*

contemplatur, quid Deo præstat? ne tanta ejus Opera sine teste sint.

*That Mans good
is a second End
proved by Scrip-
ture.*

And to proceed to that which we have formerly assign'd for the Second End of the Creation; That much of this Visible World was made for the use of Man, may appear, not only from the time of his Creation (already taken notice of) and by the Commission given to the first Progenitors of Mankind, *to replenish the Earth and subdue it, and to have Dominion over the Fish of the Sea, and over the Fowls of the Air, and over all the Earth, and over every living thing that creepeth or moveth on the Earth:* But also by God's making those noble and vast Luminaries, and other Bodies that adorn'd the Skie to give light upon the Earth, though inferior to them in Dimensions, and to divide between the Day and between the Night, and to be for Signes, and for Seasons, and for Daies, and for Years: To this agrees that Passage in the Prophet *Thus saith the Lord that Created the Heavens, God himselfe that form'd the Earth, and made it, He hath established it, He Created it not in Vaine, He formed it to be Inhabited, &c.* And the Inspired Poet speaks of Man's Dignity in very comprehensive Termes, *For thou (saies he to his Maker) hast made him little lower then the Angels, and hast Crowned him with Glory and Honour; Thou madest him to have Dominion over the Works of thy Hands, thou hast put all things under his Feet.*

Gen. 2. 28. 29.
Psal. 8. 7.
Heb. 2. 7.
Job. 5. 3.
Ho. 2. 20. 21.
22.
Rom. 8. 23
2 Cor. 3. 22.
2 Tim. 4. 3.

The same truth may be confirm'd by divers other Texts, which it might here prove tedious to insist on. And therefore I shall rather observe, that consonantly thereunto, God was pleas'd to consider man so much more then the Creatures made for him, that he made the Sun it self at one time to stand still, and at another time to goe back, and divers times made the parts of the Universe forget their Nature, or Act contrary to it; And has (in summe) vouchsafed to alter by Miracles the Course of Nature, for the instruction or relief of Man (As when the Fire suspended its destructive Opera-
tion

tion; whilst the three resolute Jewes, with their Protector, walkt unharm'd in the midst of those flames that destroy'd the Kindlers; and as the heavy Iron, emerg'd up to the swimming piece of Wood, miraculously by *Elisha* made Magnetic.) And you may also, *Pyrophilus*, take notice, that when *Adam* had transgressed, immediately the ground was cursed for his sake. And as it is not unusual in Humane justice to raze the very houses of Regicides and resembling Traitors; so when the provocations of *Sodom* swell'd high enough to reach Heaven, God did not onely destroy the Inhabitants from the Face of the Earth, but for the Inhabitants Sins destroy'd the very face of the Earth. So when in *Noah's* time a Deluge of Impiety call'd for a Deluge of Waters, God looking upon the living Creatures as made for the Use of Man, stuck not to Destroy them with him, and for him, but involv'd in his Ruine all those Animals that were not necessary to the perpetuation of the Species, and the Sacrifice due for *Noah's* preservation. And so when (in the last dayes) the Earth shall be replenish'd with those *Scoffers* mention'd by St. *Peter*, who will walk after their own Lusts, and deride the Expectation of God's foretold coming to judg and punish the Ungodly, their Impiety shall be as well punisht as silenc'd by the unexpected Flames (perhaps hastned by that very impiety) that shall either Destroy or Transfigure the World. For as by the Law of *Moses*, the Leprous Garment which could not be recovered by being washt in Water, was to be burnt in the Fire; so the World, which the Deluge could not Cleanse, a general Conflagration must Destroy.

2 King. 6. 5, 6.

2 Pet. 3. 3, 5, 6,
7, 8, 10.

Lev. 13. 54, 55.

The same proved
by Reason and
Authority. 26.
27, 28.

Nor is reason it self backward to countenance what we teach. For it is no great Presumption to conceive, that the rest of the Creatures were made for Man, since He alone of the Visible World is able to enjoy, use, and relish many of the other Creatures, and to discern the Omniscience, Almightyesse, and Goodness of their Author in them, and return Him praises for them. Tis not for themselves that the

Now the Sun
(Shemesh) is
the great minister
of the Universe.

In Probl. de
Creat.

Prov. 10. 25.
Gen. 6. 9.

2 Pet. 2. 5.

Rubies flame, other Jewels sparkle, the Bezar-stone is Antidotal; nor is it for their own advantage that fruitful Trees spend and exhaust themselves in Annual Profusions. The Light which he diffuses through the World is uselesse to the Sun himself, whose inanimate Being makes him incapable of delighting in his own splendor; which he receives but to convey it to the Earth, and other by him illuminated Globes: whence probably the Hebrews call'd him *Shemesh*, which Grammarians derive from the Root *Shemash*, signifying, in the Chaldean Tongue, *to serve*, or *minister to*; the Sun being the great Minister of Nature, and Servant general of the Universe. And as Animals alone among the Creatures seem to have a proper sense of, and complacency in, their own Being; so Man alone among Animals is endowed with Reason, at least such a pitch of it, as by which he can discern God's Creatures to be the Gifts of God, and refer them to their Creator's Glory. This Truth I find not onely embrac'd by Christians, but assented to even by Jewes and Heathens. Among the Jewes, my Learned Acquaintance, *Manasseh Ben Israel*, professedly labours to prove it by Scripture and Tradition, (though in some of his Arguments he might appear more a Philosopher, if he would have appear'd lesse a *Rabbi*) and among other passages I remember he alledges that, wherein the Wise man sayes (as our Translators English it) *That the Righteous is an everlasting Foundation*, which he renders, *Fustus est columna Mundi*, *The just man is the Pillar of the World*. And indeed if the Context did not somewhat disfavour the Interpretation, the Hebrew words [*tzaddik yesôd olâm*] would well enough bear the sense assign'd them. Congruously whereunto I remember, that when *Noah* (who is call'd in Scripture a Righteous man, and κήρυξ δικαιοσύνης, a *Herald*, or *Preclaimer of Righteousnesse*) offer'd up that noble Sacrifice of all the sorts of clean Beasts and Fowles, as a Thank-offering for the Reprieve of the World, God is said to have *smelled a savour of Rest*, and to have resolved in his Heart

Heart never to Curse the ground for Man's sake, but to continue the vicissitudes of Summer, and Winter, Day, and Night, &c. as long as the Earth shall remain. And among the Philosophers themselves, the Truth we are now manifesting, has not been altogether ignor'd. For though *Seneca* somewhere, more wittily than truly, saies, *Non causa mundo sumus hyemem a statemq; referendi, suas ista leges habent, quibus divina exercentur.* *Nimis nos suspicimus, si digni nobis videmur, propter quos tanta moveantur:* yet *Lactantius* (not to mention other Authors) tels us, that the *Stoick* generally believed the World to have been made for Man. *Vera est* (sayes he) *sententia Stoicorum, qui aiunt nostra causa Mundum fuisse constructum. Omnia enim quibus constat, quaq; generat ex se Mundus, ad utilitatem hominis accommodata sunt.* And *Seneca* himself speaks elsewhere almost as if he had read and believed the beginning of *Genesis*: *Dii* (saies he) *non per negligentiam nos genuere, quibus tam multa genuerant: Cogitavimus enim nos ante Natura quam fecit.*

Gen. 8. 21, 22.

Secundo De ira,
cap. 27.De Ira Dei,
cap. 13.

De Benef. c. 23.

Nor were the *Stoicks* the onely Philosophers, to whom the Contemplation of the Universe discover'd this end of it. For to instance now in *Cicero* onely; *Quorum igitur causa* (sayes that great Orator) *effectum esse mundum? Eorum scilicet Animantium, qua ratione utuntur: Hi sunt Dii & Homines, quibus profecto nihil est melius.*

Secundo De
Nat. Deor.

Having thus premised, *Pyrophilus*, that two of Gods principal aims in the Creation, were the manifestation of his own Glorious Attributes, and the Welfare of his noblest Visible Creature, Man; it will not be perhaps difficult for You to discern, that those who labour to deter men from sedulous Enquiries into Nature, do (though I grant, designlesly) take a Course which tends to defeat God of both those mention'd Ends.

For to speak first to the Last of them, That man's external fruition of the Creatures, and the Delight and Accommodation which they may afford him, must be highly prejudic'd

That accommoda-
tion and de-
light which the
Creatures might
afford Man, is
much impaired
by the want of
Natural Philo-
sophy.

and impair'd by his ignorance of that Natural Philosophy, wherein his Dominion over the Creatures chiefly consists, what we shall say hereafter concerning the usefulness of the Knowledge of Nature to humane Life, will sufficiently evince. But such an Animal fruition (if I may so call it) of the Works of Nature, affords not Man all the Good that God design'd him in them. For Religion being not onely the great Duty of Man, but the grand Instrument of his future Happiness, which consists in an Union with and Fruition of God, during that endless Term that shall succeed the Expiration of his transitory Life on Earth, whatever increases or cherishes his Religion, deserves to be lookt on as a great Contributor to his Happiness. And we may therefore venture to affirm, that the knowledge of the Creatures does lesse advantage Man as it enables him to Master them, than as it Assists him by admiring and serving him, to become acceptable to their Author. And whatever our distrustful Adversaries are pleas'd to surmise to the contrary, certainly God intended that his Creatures should afford not onely Necessaries and Accommodations to our Animal part, but Instructions to our Intellectual. The World is wont to be stiled not unfitly by Divines, *The Christian's Inne*, but perchance it may be altogether as properly call'd *his Ship*: for whereas both Appellations suppose him a Traveller, the Inne, though it refresh him in his Journey, does not further him in it, but rather retard his progress by detaining him in one place; whereas a Ship, not onely serves the Passenger for an Inne when he is weary, but helps to convey him towards his Journeys end. And according to this Notion, to suppose that God hath placed in the world innumerable things to feed Man, and delight him, and none to instruct him, were a conceit little lesse injurious to God, than it were to a wise Merchant, that sends persons he loves to a farre Countrey, to think that he would furnish their Cabinets with plenty of Provisions, soft Beds, fine Pictures, and all other Accommodations for their Voyage, but send them to

Sea

That the instru-
ctions to our in-
tellectual part
are more consid-
erable than the
accommodations
we have from
Nature to our
Animal part.

Sea disprovided of *Sea-Charts*, and Mariners Compasses, and other requisite Helps to steer their Course by, to the desired Harbour.

And indeed so farre is God from being unwilling, that we should pry into his Works, that by divers Dispensations he imposes on us little lesse than a necessity of studying them. For first he begins the Book of Scripture with the Description of the Book of Nature; of which he not onely gives us a general account, to informe us that he made the World (since for that end the very first Verse in the Bible might have sufficed) but he vouchsafes us by retaile the Narrative of each Dayes proceedings; and in the two first Chapters of *Genesis*, is pleas'd to give nobler hints of Natural Philosophy than men are yet perhaps aware of. Though that in most other places of the Scripture, where the Works of Nature are mentioned but incidently, or in order to other purposes, they are spoken of rather in a Popular than Accurate manner, I dare not peremptorily deny, being unwilling to interesse the reputation of Holy Writ (design'd to teach us rather Divinity than Philosophy) in the doubtful contentions of Naturalists, about such matters as may (though the Historie of the Creation cannot) be known by the meer Light of Natural Reason. We may next observe, that God has made some knowledge of his Created Book, both conducive to the belief, and necessary to the Understanding of his Written one; Our Saviour making it one cause of the Sadduces great Error about the Resurrection, that they *knew not the Power of God*. And the Scripture being so full of Allusions to, and Comparisons borrowed from the properties of the Creatures, that there are many Texts not clearly intelligible without some knowledge of them; as may appear even by the first Gospel (the Promise that the Seed of the Woman should bruise the Serpents Head, and have his Heel bruised by that subtle Creature) preached to fallen Man in Paradise, and by the representation of the Worlds four great Monarchies, and the *Genius* of each

Of the Hints of Natural Philosophy in the History of the Creation, and other references to it in other places.

30, 31.

of them under the notion of Four Beasts, in *Daniels* Prophetick Vision: and that often repeated Precept of our great Master to his Disciples, is coucht in an Expression alluding to the properties of Animals. For where he commands them to be Wise as Serpents, and Harmlesse as Doves, he does not onely recommend to them a Serpentine warinesse in declining dangers, but seems also to prescribe not alone an inoffensiveness towards others (the conspicuousnesse of which quality in Pigeons have made them, though erroneously, be supposed to have no Gall,) but also as harmlesse a way of escaping the dangers they are actually ingaged in, as that of Doves, who being pursued by Birds of prey, endeavour to save themselves not by fight, but onely by flight.

And indeed so many of the Texts in Scripture are not to be competently illustrated, without some knowledge of the properties of the Creatures related to in them, that I wonder not, that *Levinus Lemnius*, *Frantzius*, *Ruens*, and other Learned men have thought it requisite to publish entire Treatises, some of the Animals, others of the Stones, and others of the other Works of Nature mentioned in Scripture. Onely I could wish that they had been as wary in their Writings, as commendable for their Intentions, and had not sometimes admitted doubtful or fabulous accounts into Comments upon that Book, who Prerogative it is to teach nothing but Truth.

Nor ought their Labours to deter others from cultivating the same Theme: For as (such is Gods condescention to Humane weaknesse) most of the Texts, to whose Exposition Physiologie is necessary, may be explicated by the knowledge of the external, or at least more easily observed Qualities of the Creatures; so, that there are diverse not to be fully understood without the Assistance of more penetrating indagations of the Abstrusities of Nature and the more unobvious properties of things, an Intelligent and Philosophical peruser will readily discern.

Now

Now if You should put me upon telling You, *Pyrophilus*, what those Attributes of God are, which I so often mention to be visibly displayed in the Fabrick of the World, I can readily answer You, That though many of Gods Attributes are legible in his Creatures, yet those that are most conspicuous there are his Power, his Wisdom, and his Goodnesse, in which the World, as well as the Bible, though in a differing, and in some points a darker way, is designed to instruct us, which that You may not think to be affirmed *gratis*, we must insist a while on each of the Three.

And first, How boundlesse a power, or rather what an Almightinesse is eminently displayed in God's making out of Nothing all Things, and without Materials or Instruments constructing this immense Fabrick of the World, whose Vastnesse is such, that even what may be prov'd of it, can scarcely be conceiv'd, and after a Mathematical Demonstration its Greatnesse is distrust'd? Which yet is, I confesse, a Wonder lesse to be admired than the Power expressed by God in so immense a Work, which nevertheless some modern Philsophers (whose opinions I find some Cabalists to countenance) suppose to be not the only Production of Gods Omnipotence. Not to mention *Elephants*, or *Whales*, some of which an Hyperbolist would not scruple to call moving Mountains, and floating Islands; and to passe by those stupendous Hills, and those Seas, where the Light looses it self, as Objects which their neernesse onely represents so Bulky; let us hasten to consider, that whereas the Terrestrial Globe we Men inhabit, contains, besides all those vast Kingdomes, the Union of some of which constituted the Worlds four celebrated Monarchies, those spacious (since detected) American Regions, that have been deservedly stiled *The new World*; and that whereas the Common Account makes the Circuit of this Terrestrial Globe to be no lesse than 22600 *Italian* miles, consisting each of 1000 Geometrical paces (which number the more recent account of the accurate *Gassendus* makes amount

How Gods power is conspicuous in the Creatures.
32.33.34.

amount to 26255 Miles of the same measure) whereas, I say, this Globe of Earth and Water seems to us so vast, Astronomers teach us, that it is but a Point in comparison of the Immensity of Heaven; which they not irrationally prove by the Parallax (or Circular difference betwixt the place of a Star, suppos'd to be taken by two Observations, the one made at the Centre, and the other on the surface of the Earth) which *Gassendus* confesseth to be undiscernable in the fixt Stars: as if the Terrestrial Globe were so meere a Point, that it were not material, whether a fixt Star be lookt upon from the Centre, or from the surface of the Earth. This may lessen our wonder at the *Ptolomaens*, making the Sun (which seems not half a Foot over) to be above a hundred sixty and six times bigger than the Earth, and distant from it One thousand one hundred sixty and five Semi-Diameters of the Earth, each of which contains, according to the aforementioned computation of *Gassendus*, 4177 Miles; and at their supposing the fixt Stars (whose distance the same Author, as a *Ptolemaean*, supputes to be 19000 Semi-Diameters of the Earth) so great, that they conclude each of the fixt or smallest magnitude to be no lesse than 18 times greater than the whole Earth, & each Star of the First or Chief Magnitude to exceed the Terrestrial Globe 108 times. And as for the *Copernicans* (that growing Sect of Astronomers) they, as their *Hypothesis* requires, suppose the vastnesse of the Firmament to be exceedingly greater than the Ancients believed it. For *Philippus Lansbergius*, who ventured to assign Distances and Dimensions to the Planets and Fixt Stars (which *Copernicus* forbore to do) supposes as well as his Master, that the Great Orb it self (as the *Copernicans* call that in which they esteeme the Earth to move about the Sun) though its Semi-Diameter be suppos'd to be 1500 times as great as that of the Earth, is but as a Point in comparison of the Firmament or Sphere of the Fixt Stars; which he supposes to be distant from the Earth no lesse than 28000 Semi-Diameters of the Great Orb, that is, 42000000 of Semi-Diameters

Gassend. Inst.
Astr. lib. 2. c. 13.

Gassend. lib. 3.
cap. 11.

diameters of the Earth; or according to the former Computation of common Miles 175434000000, which is a Distance vastly exceeding that which the *Ptolomeans* ventur'd to assign, and such as even imagination it self can hardly reach to. I confesse indeed, that I am not so well satisfied with the exactness (nor perhaps with the Grounds) of these kind of Computations, by reason of the Difficulty I have met with in making exact Celestial Observations with either Telescopes, or other Instruments, sufficiently witnessed, by the great disparity remarkable betwixt the Computations of the best Artists themselves. But on the other side I am not sure but that even the *Copernicans* ascribe not too great a distance to some of the Fixt Stars; since (for ought we yet know) those of the sixth Magnitude, and those which our Telescopes discover (though our bare Eyes cannot) are not really lesse then those of the first Magnitude, but onely appeare so by reason of their greater Distance from our Eyes; as some Fixt Stars seem no bigger then *Venus* and *Mercury*, which are much lesse then the Earth. And therefore upon such Considerations, and because the modestest Computation allowes the Firmament to be great enough to make the Earth but a Point in comparison of it; it will be safe enough, as well as just, to conclude with the Psalmist, *Great is the Lord, and greatly to be praised; and his greatness is unsearchable.*

The next Attribute of God that shines forth in his Creatures, is his Wisdome; which to an intelligent Considerer appears very manifestly expressed in the World, whether you contemplate it as an Aggregate or System of all Natural Bodies; or consider the Creatures it is made up of, both in their particular and distinct Natures, and in Relation to each other, and the Universe which they constitute. In some of these the Wisdome of God is so conspicuous, and written in such large Characters, that it is legible even to a Vulgar Reader: But in many others the Lineaments and Traces of it are so delicate and slender, or so wrapt up and cover'd with Corporeity, that

How Gods wisdom is conspicuous in them.

it requires an attentive and intelligent Peruser. So numberlesse a multitude, and so great a variety of Birds, Beasts, Fishes, Reptiles, Herbs, Shrubs, Trees, Stones, Metals, Minerals, Stars, &c. and every one of them plentifully furnish'd and endow'd with all the Qualifications requisite to the Attainment of the respective Ends of its Creation, are productions of a Wisdome too limitleffe not to be peculiar to God: To insist on any one of them in particular (besides that it would too much swell this Discourse) might appear injurious to the rest; which do all of them deserve that extensive Exclamation of the Psalmist,

Psalm 104. 24.

How manifold are thy workes, O Lord; in Wisdome hast thou made them all. And therefore I shall content my selfe to observe in generall, That as highly as some Naturalists are pleased to value their own knowledg, it can at best attain but to understand and applaud, not emulate the Productions of God. For as a Novice; when the curioslest Watch the rarest Artist can make, is taken in pieces and set before him, may easily enough discern the Workmanship and contrivance of it to be excellent; but had he not been shown it, could never have of himselfe devised so skilfull and rare a piece of Worke: So, for instance, an Anatomist, though when by many and dexterous Dissections of humane Bodies, and by the help of Mechanical Principles and Rules (without a competent skill wherein, a Man

Particular Observations of the structure of humane body.

can scarce be an Accomplish'd and Philosophical Anatomist) he has learn'd the Structure, Use and Harmony of the parts of the Body, he is able to discern that matchlesse Engine to be admirably contriv'd, in order to the exercise of all the Motions and Functions whereto it was design'd: And yet this Artist, had he never contemplated a humane Body, could never have imagin'd or devis'd an Engine of no greater Bulk, any thing near so fitted to perform all that variety of Actions we daily see perform'd either in or by a humane Body. Thus the Circular motion of the Blood, and structure of the Valves of the Heart and Veins (The consideration whereof, as himselfe told me, first hinted the Circulation to our Famous *Harvey*) though

now

now Modern Experiments have for the main (the *Modus* seeming not yet so fully explicated) convinc'd us of them, we acknowledge them to be very expedient, and can admire Gods Wisdome in contriving them: Yet those many Learned Anatomists, that have for many succeeding Ages preceded both Dr *Harvey*, and *Columbus*, *Casalpinus*, *Padre Paulo*, and Mr *Warner*) for each of these four last are suppos'd by some to have had some notion of the Circulation) by all their diligent contemplation of humane Bodies, never dream'd (for ought appears) of so advantageous an use of the Valves of the Heart, nor that nimble Circular motion of the Blood, of which our modern Circulators think they discern such excellent Use, not to say, Necessity-

And though it be true, that the greater Works of God do as well declare his great Wisdome as his Power, according to that of the Inspired Philosopher; *The Lord by Wisdome hath founded the Earth, by understanding hath he establish'd the Heavens. By his Knowledge the depths are broken up, and the Clouds drop down the Dew:* Yet does not his Wisdome appear lesse in lesser Creatures; for there is none of them so little, but it would deserve a great deal of our Wonder, did we attentively enough consider it. And as *Apelles* (in the Story) was discover'd by the skilful *Protagoras*, by so neat and slender a Line, that *Protagoras*, by being scarce able to discern it, discern'd it to have been drawn by *Apelles*: So God, in these little Creatures, oftentimes draws traces of Omniscience, too delicate to be liable to be ascrib'd to any other Cause: I have seen Elephants, and admir'd them less then the structure of a dissected Mole, which hath better Eyes then those, that will not see a designation in the dimnesse of its Eyes (made onely to see the Light, not other Objects by the help of it) and the unwonted posture of its Feet, given it not to run on the Ground, but to dig it self a way under Ground. And, as despicable as their Littlenesse makes the vulgar apt to think some Creatures I must confess my wonder dwells not so much on Natures

Prov. 13. 19. 20

Of the Eyes and feet of Moles.

Clocks (if I may so speak) as on her Watches, and is more exercis'd in the coynesse of the sensitive Plant, and the Magnetical Properties of a small and abject Load-stone, then the bulk of the tallest Oakes, or those vast Rocks, made famous by Shipwracks. I have pass'd the *Alpes*, and have seen as much to admire at in an Ant hill, and have so much wondred at the Industry of those little Creatures themselves that inhabited it, that I have ceas'd to wonder at their having given a Theme to *Solomon's* Contemplation. Those vast Exotick Animals which the Multitude flocks to see, and which Men give Money to be allow'd to gaze on, have had many of them lesse of my Admiration, then the little Catterpillar, (as Learned Naturalists esteem it) to which we are beholden for Silk. For (not to mention all the Observables crouded by Nature in that little Worm) I thought it very well deserv'd my wonder (when not long since I kept some of them purposely to try Experiments) how this curious Spinster, after he had buryed himself alive in the precious Tomb he had wrought for himself out of his own Bowels, did cast off his former Skin and Legs, and, in shew, his former Nature, appearing for divers dayes but an almost movelesse Magot; till at length, divesting this second Tegument also (in which Nest, Phenix-like, he had been regenerated out of his own Remains) he came forth (if I may so speak) out of his attiring Room under another form, with Wings, Eyes, and Leggs, &c. to act a new part upon the Stage of the World; which having spent some dayes without feeding (that I could observe) in providing for the propagation of his Species) he forsakes and dies. And I the rather mention the Silk-worm, because that there have been of late divers subtle Speculators, who would fain perswade us, That Animals do nothing out of Instinct, or, if you please, innate or seminall Impressions; but Spin, build Nests, and perform all the other Actions for which they are admir'd, barely by Imitation of what they have seen done by others of the same Kind. But in the Silk-Worme

Of the Silk.
worm.

That it works by
instinct and not
by imitation.

(at

(at least here in *England*) this plausible Opinion will not hold : For the Silk-worms I kept, were not hatch'd but in the Spring, out of Eggs laid some Dayes in the Sun ; and the Worms that laid those Eggs, being every one of them dead the Winter before, it was impossible these new Silk-Worms, when they first began to spin their scarce imaginable fine Web, and inclose themselves in Oval Balls of a very Artificial Figure and Texture, should have wrought thus by Imitation ; there not having been for many Moneths before, in the place where they were hatch'd (nor perhaps in the whole Country) any Silk-Worms alive which they might imitate. But I must leave these curious Spinsters to their Work, and proceed to tell you that Seas and Mountains, with the other Hyperholes of Nature (if I may so term them) proclaim indeed Gods Power, but do not perhaps more manifest his Wisdome, then the contrivance of some living Engines, and (if I may so call them) Breathing Atoms, that are so small that they are almost all Workmanship; so that, as before, in the Psalmists Expression we truly said of Gods Greatnesse; *That it was unsearchable*; we may now as truly say of his Wisdome in the Prophets Words, and in the same Text where he represents him as the Creator of the ends of the Earth, *That there is no searching of* Isa. 40. 28. *his Understanding.*

And if I durst, *Pyrophilus*, make this part of this Essay of a length too disproportionate to the rest, I could easily, as well as willingly, represent to you divers things which might serve to Illustrate the *πολυτροπία καὶ ὁμοιότης* Eph. 3. 10. *manifold Wisdome of God* (as *St Paul* speaks on another occasion) But though I dare not expatiate on this Subject, yet neither dare I altogether conceal from you, that I have sometimes admired to see what scarce imaginable variety of living Engines his plastick skill (if I may so speak) has been able to produce, (especially in the Waters) without scarce any other resemblance betwixt them, then that they are each of them excellent in its own Kind, and completely furnish'd according to the exigency of its

Jer. 10. 16.

Gassend. in Vit.
Petreskii, lib. 4.Of the vastness
of the Elephant
and its dispropo-
rtion to the
largest and such
like Mites.

its Nature. And that which much encreases this Wonder, is the disproportion of those living Engines, wherein the great [Totzêer hakkôl] Former of all things (as the Scripture justly calls God) has been pleas'd to display an almost equally skilful Contrivance. Amongst Terrestrial Animals we have the Elephant, of whose stupendious vastness such strange things are related, even by eminent Writers, that I know not well how either to dis-believe them, or give credit to them: And therefore we shall content our selves to mention that which is left on Record by the accurate *Gassendus* in the Life of *Petreskii*; For this matchlesse Gentleman having caus'd an Elephant, in the Year 1631, to be weigh'd in a Scale, purposely provided, he was found to weigh, of the Roman Pounds (consisting of twelve Ounces a piece) very near Five thousand: And yet surely that this Elephant was very far from being one of the largest of that sort of Beasts, he that shall consider the bigness and length of some of their Teeth, as they are commonly call'd which are to be seen at divers places, both in *England* and elsewhere, and is not resolv'd not to believe the consonant Relations of Eastern Travellers (among whom *Linschoten* tells us there have been some Teeth found to weigh Two hundred pounds a piece, each pound consisting of twenty four Ounces) may be easily perswaded. On the other side let us reflect upon the smalness of some Terrestrial Animals; and not to mention that little white Creature bred in Wax, which *Aristotle* calls 'Αργει, and speaks of as suppos'd to be the least of all living Creatures whatsoever: Let us consider those little Mites that are bred in mouldy Cheese; for divers of these scarce amount to the weight of a Grain, and every Pound containing Five thousand seven hundred and sixty Grains; supposing each Mite did weigh a whole Grain, yet that formerly mention'd small Elephant would exceed him near 28800000 time. And yet though a Mite seem but a moving Atome, and unless there be divers together, is not easily discern'd by the unassisted Eye; yet in an excellent Microscope I have, you know, several

several times both seen and shewn to others, even in a gloomy Day, and a disadvantageous Place, not onely the Limbs of this little Animal, but the very Hair growing upon his Legs. Now let us but consider how strangely skilfull and delicate a Workmanship must be employ'd to contrive into so narrow a compasse, the severall parts Internal and External, requisite to make up this little Animal; how many must go to the texture of the Eyes, and other Organs of Sense; how many to the Snout (which he has, not unlike a Hog) and the several parts of it; how many to the Stomach and Guts, and the other Inward parts addicted to the digestion of Aliment, and exclusion of Excrements; and to be short, how unimaginably subtle must be the Animal Spirits running too and fro in Nerves suitable in such little Legs: And if, as we have observ'd them to multiply by Egges, the little Creatures be hatch'd in those little Egges, after the manner of divers other Oviparous Animals, how much smaller then a hatch'd Mite must be a Mite upon the Animation of its delineated Parts? since in Hens Egges we have sometimes seen the Chick manifestly alive, and its Limbs clearly delineated, whilst yet it took up so small a portion of the Egge, that both the White and the Yolk (betwixt which it is generated, and not of the *Chalaza* or *Tredle*, as *Aquapendente* and other Moderns teach) seem'd to be sometimes yet intire, as well as invol'd in their peculiar Membranes. But it is not so conspicuous in gradient Animals (if I may so speak) as in swimming ones; How vastly disproportionate Masses of Matter the wise *Former of all Things* can fashion into living Engines. For Whales are much more stupendious Creatures then Elephants: And not to mention what *Hartenius* (*apud Fohnstonum*) tells us of twenty sorts of Whales, whereof the eighteenth Species, which he calls *Nordhwal* is by him related to be Ninety Ells long; but what Ells he means, I know not: Nor to mention those lesse incredible Accounts which are given of the vastnesse of Whales by our English Navigators, who are wont to Fish for them; I shall onely set
down

For: *Faber Lyn-*
ceus in his Ex-
 position of some
 Passages of p.
 568.

Of the wastnesse
 of the whale and
 its disproportion
 to the small
 Worms or fishes
 lately discovered
 in Vineger,

down what is related by one of the eminentest Modern *Lyn-*
cean Philosophers, because he speaks as an Eye-witnesse, when
 he tells us, That in the Yeare 1624, there was cast upon a place
 near *Santa Severa*, about 30 Miles from *Rome*, a dead Whale
 of 91 Palms in length, and 50 in thicknesse: He addes, That
 its Mouth was 16 Palms long, and 10 high; in which, being
 opened and kept gaping; a Man on Horse-back might find
 competent room; this Mouth being used to harbor a Tongue
 of twenty Palms (which may make out fifteen Foot) in length.
 The same inquisitive Writer addes, That foure Yeares before,
 near the Island of *Corfica*, not far from the Coast of *Italy*, ano-
 ther Whale was cast, One hundred Foot long, which being a Fe-
 male, was found to be big with a Cub of thirty Foot long,
 1500 pound weight. But that which will let you see, *Pyro-*
philus, the disproportion betwixt these kind of Fishes and
 common Elephants, is, that which the same Author addes,
 That the Lard onely, or Fat (as he speaks *Carnea pinguedo*) of
 this corpulent Creature, weigh'd One hundred and thirty five thou-
 sand pound, that is, above Twenty seven times the weight of
 the whole Elephant, which was caus'd to be weigh'd by *Pei-*
reskius. And though the Omnipotent Creator be able to
 make swimming Creatures of such prodigious bignesse, that
 the Ocean it self may seem to be but a proportionate Pond for
 such Fishes; yet is the same Omniscient Continuer, as able
 to make a swimming Engine more slender then a Cheese Mite,
 and so little, that the small part of a Grain may out-weigh di-
 vers of them. For, *Pyrophilus*, I must here acquaint you
 with a strange Observation, which I have been inform'd to
 have been some while since made in *Italy* by *Panarola* a Fa-
 mous Physitian in *Rome*, who is said, by the help of an ex-
 cellent Microscope, to have discern'd in Vinegar small Living
 Creatures, which he takes to be Wormes. The mention of
 so unlikely an Experiment, made me engage some excellent
 Philosophers and Mathematicians to assist me in examining it:
 But though our Microscopes exceeded the best that were
 brought

brought us over from *Rome*, yet all our diligence and attention did but make them conclude that *Panarola's* Eyes had been deluded. Notwithstanding which, causing a somewhat hollow bottom of pure Chrystalline Glasse to be fitted to my Microscope, I prosecuted the Enquiry my self; and at length was so lucky, as not onely to discover these little Creatures with a Microscope, but by holding the Liquor in a Chrystal Viol, almost upon the strong Flame of a Candle, to discover multitudes of them with my naked Eyes, as weak as they are. But though I have already convinc'd those that formerly derided such Observations, as not to be made with the best Microscope, yet the great weaknesse of my Sight has not permitted me to perfect my Observations concerning these Creatures. And therefore reserving the more particular mention of this odde Observation till another time, I shall now onely tell you as much as is pertinent to our present purpose; namely, That having with a certain parcel of strong White-wine Vinegar (for tis not in every Vinegar that they are constantly to be found) fill'd up to the top thin Viols, with long and slender Necks; and having likewise with the same Liquor fill'd other small Chrystalline Viols, though short-neck'd, and held them betwixt my Eye and the Sun, or a Window open towards it, or very neer a great Candle, I have often in these Glasses, especially in their slender Necks, after having a while fixt my Eye on them, (attention being in this case very necessary) admirably observ'd great numbers (and sometimes as it were Shoals) of living Creatures, which seem'd to be rather Fishes than Worms; for they swim freely up and down the Liquor, and often hover about the top of it with a wrigling motion, like that of Eels, to which likewise their long and slender shape resembles them. And though these swimming Creatures be not all exactly of a size, yet some of them seem'd slenderer than any sort of living ones, that hath hitherto been taken notice of by the unassisted Eye. And I remember, that having look'd in a good Microscope upon one of them, and a Cheese-

mite much about the same time, the Fish appear'd so slender, that we judg'd it not much thicker than one of the Legs of the Mite: So that considering what a vast deal of matter the great Creator can manage and fashion into a Whale, and in how little room he can contrive all the parts requisite to constitute a Fish, we may justly say to him in the Psalmists Language, *there is none like unto thee (O Lord) neither are there any works like unto thy works.*

Psalm. 86. 8.

How Gods goodness is conspicuous in his Creatures by his provision of accommodations for them all, but especially for his favourite Man.

Nehem. 9. 6.

Gen. 8. 17.

The last of the three properties of God, which we mentioned him to have manifested in the Creation, is his Goodnesse; of which all his Creatures do in their due measure partake, partly by their having a Being vouchsafed them, and partly by their being preserved in it as long as their subordination to higher purposes and to more powerful Creatures do permit, by that supporting Influence of God which keeps them from relapsing into their first Nothing; according to that memorable passage, where *Nehemiah* having mentioned God as the *Creatour of the Heavens, the Earth, the Seas, and all the Creatures belonging to them,* he calls Him the *Preserver*, or (as the Original has it) *the Enlivener of them all.* And as for Animals, who are more capable of enjoying, though not most of them of discerning his Bounty, his Goodnesse to them is more conspicuous. For besides that in Scripture he is called the *Preserver both of Man and Beast*, and accordingly is said to *give food even to the Young Ravens that cry,* and to have, after the *Flood*, remembered not onely *Noah*, but *every living thing that was with him in the Ark*, his Goodnesse to them is apparent by the plentiful and easily attainable provision he makes according to the exigence of their several Natures. For that innumerable swarm of various Birds, Beasts, Fishes, Reptiles, and other Animals that people the Terrestrial Globe, and the contiguous parts of the World, and by his endowing each of them with all the Qualifications requisite to the perpetuation of their Species, and the preservation of their Lives, as far forth as is consistent with his Ends

in their Creation: But most resplendent does the Goodness of God appear towards his Favourite Creature, Man, whom having vouchsaf'd to enoble with his own Image, he makes most of the Creatures of the World, visible to us, pay homage to him, and in some manner or degree do him service: God's liberality at once bestowing on him all those Creatures, by endowing him with a Reason enabling him to make use of them; so that even those Creatures which he is not able to subdue by Power, he is able to make serviceable to him by his Knowledge: as those vast Globes of Light, which are so farre above him, that their Immenfity and Brightness can scarce render them visible to him, are by man's Mathematicks forced to give him an account of all their Motions, and waiting upon his Dials keep time for him; and even the defects of such works of Nature, are by man's skill made serviceable to him, as the Eclipses of the Moon serve Geographers notably in that difficult and useful work of finding Longitudes. The Stars serve for Candles to give man Light, and the Celestial Orbs are his Candlesticks. He breaths the Air, the Fire warms him, and serves him not onely in his Kitchen, but to master most other Bodies in his Furnaces: The Clouds water his Land, the Earth supports him and his Buildings, the Sea and Winds convey him and his Floating houses to the remotest parts of the World, and enable him to possess every where almost all that Nature or Art has provided for him any where. The Earth produces him an innumerable multitude of Beasts to feed, cloath, and carry him; of Flowers and Jewels to delight and adorn him; of Fruits, to sustain and refresh him; of Stones and Timber, to lodge him; of Simples, to cure him; and in summe, the whole sublunary World is but his Magazine. And it seems the grand business of restless Nature so to constitute and manage his Productions, as to furnish him with Necessaries, Accommodations, and Pleasures.

Of such a Number of Plants, Animals, Metals, Minerals, &c. that people and enrich the Terrestrial Globe, perhaps there is not any one, of which Man might not make an excellent use, had he but an insight into its Nature: nor are the most abject and despicable therefore the least useful. There is not any Stone, nor not the sparkling Diamond it self, to whom Man is so much beholden, as he is to the dark and unpromising Load-stone; without which the New-world probably had never been detected, and many Regions of the old World would have little or no Commerce with each other. Nor have the *Lyon*, the *Eagle*, and the *Whale*, joyned all together, (though reputed the Chief of Birds, Beasts, and Fishes) been so serviceable to Man, as that despicable Insect, the *Silkworm*. And if we impartially consider the Lucriferousnesse (if I may speak in my Lord of St. *Albans* stile) of the properties of Things, and their Medical Virtues, we shall find, That we trample upon many things, for which we should have cause to kneel, and offer God praises, if we knew all their Qualities and Uses. But of this Subject we may elsewhere purposely treat.

Of the unknown
and new detect-
ed Properties &
Virtues of di-
verse Concretes.

To which I must onely adde, *Pyrophilus*, That you will injure Nature, if You suppose, either that all the Concretes, endowed with excellent Properties, have long since been notorious; or that all the Medicinal Virtues of Simples, commonly us'd, are already known; or that all those Concretes are destitute of considerable Properties, to whom none have been yet ascrib'd by eminent Authors. For almost every day either discloses new Creatures, or makes new Discoveries of the usefulness of things; almost each of which hath yet a kind of *Terra incognita*, or undetected part in it. How many new Concretes, rich in Medicinal virtues, does the New World present the inquisitive Physicians of the Old? *Notatu dignum* (says the ingenious *Piso*, in his new publish'd *Medicina Brasiliensis*, lib. I.) *quod eximia tot arbores, frutices, & innumera herba, figura, foliis & fructibus à veteris orbis Vegetabilibus, paucis*

ex:

exceptis, dissimillima appareant. Inde de aribus, animantibus, & piscibus deprehenditur, ut & insectis alatis, atq; alis destitutis, quae ineffabili colorum pulchritudine & portentosa multitudine generantur, partim nota nobis, partim incognita. And

of the known *American* Simples, how many latent Virtues does Experience from time to time discover? And (to mention now no others) the Febrifugal property of that *Peruvian* Tree, called by the Natives *Gannanaperide*, whose Bark, call'd commonly *China Febris*, has been at *Rome*, and freshly also at *London*, found so wonderfully effectual against those stubborn Diseases, *Quartain Agues*; and though a Learned Author endeavours to depreciate it, by alledging, That it is wont rather to suspend the Fits, than truly cure the Disease, which after awhile will return again; yet, besides that, it may be often very beneficial to a weakned Patient, to have his Fits put off, the Physician thereby also gaining opportunities to imploy strengthning and preventing Remedies: besides this, I say, if you will credit that great Person, Sir *Kenelm Digby*, it is rather the Patients or Doctors fault, than the Medicines, if the Disease return. For having purposely consulted him about this Objection against the Use of the *Cortex Febrifugus*, he solemnly assur'd me, That of betwixt Twenty and Thirty persons, that he had himself cur'd of *Quartanes* by this Remedy, not so many as Two fell into a Relapse.

And now I am upon the more freshly discover'd Virtues of *American* Drugs, I might acquaint you with the admirable Properties, not onely in Diseases, but even in Wounds of a certain Mineral, which (though careful examination of it has not yet taught me to what Species of Stones to reduce it) you cannot but have heard mention'd with wonder, under the name of Sir *Walter Rawleigh's* Stone, which my Father, & ungratefully enjoy'd, and did strange things with for many years, and by his Will bequeathed (as the highest Legacy he could leave him) to his dearest Friend, the most Learned and Famous *B. Usher*, *Primate of Ireland*. But of this Stone, the merit of the sub-

Of the *Peruvian* Bark, commonly called the *Jesuites* Powder.

Of the Use of *Paronychia foliata* rutacea in the Kings-Evill, & of divers other Concretes observable for their unknown properties.

ject makes me reserve what I have to say, to a Discourse wherein I may be allowed to say more to it than now I dare; and therefore I shall proceed to tell You, that tis not in the Simples of the New World onely, that new Medicinal properties may be discover'd; for even those which daily obtrude themselves upon our careless Eyes, or are trampled under our regardlesse Feet, may possesse Virtues, to which the major part of Botanists are meer Strangers. To which purpose I remember that I have often gather'd a litle short-liv'd and despicable Plant, (namely *Paronychia folio Rutaceo*) with which alone (slightly infus'd in Beer) I lately knew a young Kinsman of Sr. Keneim Digbles in few days, and without pain, as both Himself, his Mother, and his Physitian assur'd me, cur'd of that stubborn and seldom vanquish'd Disease of the King's Evil, against which it doth Wonders; and yet having consulted not onely some of the famousst and recentest Herbals, both English and Latine, about this, but also enquired of two or three eminent Herbarists, I could find neither any such Virtue, nor almost any at all, ascribed by Authors to that excellent Plant.

Of the use of divers noxious concretes, and that they contain their own Antidotes.

And whereas Gods bounty to Man in the Creatures seems a litle clouded and streightned by his permitting some poisonous Plants and venomous Animals to have a Being in Nature; to that it may be replied, First, That many poysonous Bodies contain their own Antidotes: insomuch that the diligent *Piso*, who hath had great opportunities to examine the Effects of both, ventures to say, treating of the Poysons and Antidotes to be met with in *Brasil*, *Equidem vix dixeris, Venena an Alexiteria plura sint pronata*: and a litle lower, *Sic folia, flores, & fructus herbarum Tangaraca & Fuquerii, venena Brasilia facile prima, propriam suam unaquaq; radicem oppositum habet Antidotum*: and a litle after, *Barbari viperarum pinguedinem & capita, tum & integra Insecta qua vulnera intulerint, ex arte parata, audacter & felici cum successu venenatis ictibus applicant; adeoque per ipsos effectus comprobare nituntur in omni veneno contineri suam Antidotum*. And next, that the

the noxiousness of many (and therefore not improbably of all of them) is not so incorrigible, but that by Man's Art and Chymical Preparations, they may be made, not onely innocent and harmelesse, but useful too. This Truth, *Pyrophilus*, Antimony and Quick-silver, and some other noxious Bodies (which Men have learn'd to make Medicinal) have already taught our Modern Physicians; who prescribe even in their Dispensatories, divers Medicines made out of those churlish Minerals, to which in the ensuing Discourses, you will find divers others (perhaps not inferiour) added. That *Opium* is reckon'd by Physicians among Poysons, I need not tell You; and yet such powerful Remedies may be made with it for many desperate Cases, especially in hot Countries, that the good it may doe, so much exceeds the harm, that Physicians would be sorry there were none of it in the World. The Oyl of Scorpions is not onely Antidotal against their Stings, but is witnessed by Experience, to be very useful to bring away the descending Stone of the Kidneys, and to remedy divers other Mischiefs, besides those that Scorpions can do. And to these I shall need but to adde one Instance more, because of the nobleneffe of that single one, and that is the Root *Mandihoca*, so common all over the *West Indies*: for Nature is so far from having been a Step-Mother to Man in making that Plant abound so much in those Countries, though in its crude simplicity (as the *Helmontians* speak) it be confessedly a rank Poison, that she hath scarce in any one Plant been so bountiful to the *Americans*. For by a slight and easie preparation, which we shall hereafter mention, it affords many populous Nations almost all the Bread they eat, and some of them a good part of their Drink; the Root freed by a strong Press from the noxious Juice, and dry'd, affording them that *Cassavy* Meal, whereof they make their Bread, which by the Taste and Colour I could not discern to be other than good. Nor is this the onely use this poisonous Plant affords them: For the above-commended *Piso* gives us this short, but comprehensive

Cha-

Of that excellent
west Indian root
Mandihoca.

Character of it: *Ex Mandiboca radice maximo scitente veneno, optimum Alimentum non solum, sed & Antidotum concinnatur.* (lib. 3.) But concerning the use that may be made of Poysonous Creatures, we elsewhere professedly discourse: And shall therefore now proceed to observe to you here, that I have not yet mention'd to you the instance which most manifests the greatnesse of the Good which God intended Man in the Creatures. For, not content to have provided him all that was requisite either to support or Accommodate him here, he hath been pleas'd to contrive the World so, that (if Man be not wanting to himself) it may afford him not onely Necessaries and Delights, but Instructions too. For each Page in the great Volume of Nature is full of real Hieroglyphicks, where (by an inverted way of Expression) Things stand for Words, and their Qualities for Letters. The Psalmist observes, *That the Heavens declare the glory of God:* And indeed, they celebrate his Praises, (though with a soundlesse voice, yet with so loud a one (and which gives us the Moral of *Plato's* exploded notion of the Musick of the Spheres) to our intellectual Ears, that he scruples not to affirm, that *there is no speech nor Language where their voice is not heard,* (or as *Junius* and *Tremellus* render it, without violence to the Hebrew Text, *There is no speech nor Words, yet without these their Voice is understood*) and *that their Line is gone throughout all the Earth,* that is (as the Learned *Diodati* expounds it) their Writing in grosse and plain Draughts, and their Words to the end of the World: Their Language having so escap'd the confusion of Tongues, that these Natural and Immortal Preachers give all Nations occasion to say of them, as the Assembly at Pentecost did of the Inspir'd Apostles, *We do hear them speak in our Tongues the wonderful works of God.*

How we are by
the Creatures in-
structed to De-
votion.

Psal. 19 .1.

Acts 2. 11.

Nor can we, without listning to these Sermons, derive the entire(perhaps not the chiefeſt) benefit design'd us in the Creatures. For sure, that God, who hath compos'd us both of Body and Soul, hath not confin'd the Uses of so many admirable

nable Creatures, and so much inimitable Workmanship to that ignoble part of Man which coupleth him to the Beasts, with the neglect of that Diviner Portion, which allies him to the Angels; vouchsafing to the Lord of the Creatures, in the fruition of this his Palace, no higher Prerogative than he is pleas'd to allow to the Brutes, that serve but to compleat the variety requisite for its embellishment. Of this Opinion I lately found that excellent Writer, *St. Austine*, to have been before me: For, *Non debes uti oculis* (sayes he) *ut pecus, tantum ut videas, quæ addas ventri, non menti: utere, ut homo, intende Calum, & intende facta, & quare factorem; aspice quæ vides, & quare quem non vides, crede in eum quem non vides, propter ista quæ vides. Nolite fieri sicut equus & mulus, &c.*

Nor can the Creatures onely informe Man of God's Being and Attributes (as we have already seen) but also instruct him in his own Duties: For we may say of the World, as *St. Austin* did of the Sacraments, that it is *Verbum visibile*. And certainly, God hath never so confin'd himself to instruct Men by Words or Types, as not to reserve himself the liberty of doing it by Things: Witnesse his appointing the Rainbow to Preach his Goodnesse to all Nations, and fortifie the Faith of Mankind against the fear of a second Deluge. 'Tis something too high a saying for an Heathen, that of *Plato*, where he teaches, *That the World is Gods Epistle, written to Mankind*. For by *Solomon* God sends the *Juggard to school to the Ant*, to learn a provident Industry: *Christ* commands his Disciples to *learn of Serpents and Pigeons* prudence and inoffensiveness. The same Divine Teacher enjoyns his Apostles to *consider the Lillies*, or (as some would have it) the *Tulips of the Field*, and to learn thence that difficult Virtue or a distrustless reliance upon God. And *St. Paul* seems almost angry with the *Corinthians*, That their Faith, in so abstruse My-

D. Aug. Hom. 3

1 Cor. 15. 36, 37.

Psal. 8. 3; 4.

ty, by the Contemplation of the most elevated parts of Nature; *When I consider (saies he) the Heavens, the work of thy Fingers, the Moon and Stars which thou hast ordained, what is Man, that thou visitest him?* Thus you may see that God intended the World should serve Man, not onely for a Palace to live in, and to gaze on, but for a School of Virtue; to which his Philanthropy reserves such inestimable Rewards, that the Creatures can on no account be so beneficial to Man, as by promoting his Piety; by a competent degree of which, God's goodnesse hath made no lesse than Eternal Felicity attainable.



ESSAY





E S S A Y III.

Containing a Continuation of the Former.

HAVING thus, *Pyrophilus*, endeavoured to evince, that the Opinion that would deter men from the scrutiny of Nature, is not a little prejudicial to man's Interests, and does very much lessen the Advantages he may derive from the Creatures, both in relation to his accommodation in this Life, and his Felicity in the next: Let us proceed to consider, whether the Doctrine we oppose do not likewise tend, in its own nature (though not in the intentions of its Patrons) to defeat God of much of that Glory which Man both ought and might ascribe to him, both for himself and the rest of the Creatures. How unlikely is it that we should be able to offer to God that Glory, Praise, and Admiration, he both expects and merits from such a Contemplation of the Creatures, as though it be requisite to the true knowledg of their Nature and Properties, is yet suppos'd either pernicious, or at least dangerous, You, *Pyrophilus*, or any other impartial Person may easily determine.

That their Opinion who would deter men from the Scrutiny of Nature tends to defeat God of much of that glory Man should ascribe unto him.

For the Works of God are not like the Tricks of Jugglers, or the Pageants that entertain Princes, where Concealment is requisite to Wonder; but the knowledg of the Works of God proportions our Admiration of them, they participating and disclosing so much of the inexhausted Perfections of their Author, that the further we contemplate them, the more Foot-steps and Impressions we discover of the Perfections of their Creator; and our utmost Science can but give us a juster

veneration of his Omniscience. And as when some Country Fellow looks upon a curious Watch, though he may be hugely taken with the rich Enamel of the Case, and perhaps with some pretty Landskip that adorns the Dial-plate; yet will not his Ignorance permit him so advantageous a Notion of the exquisite Makers skill, as that little Engine will form in some curious Artist, who besides that obvious Workmanship that first entertains the Eye, considers the exactness, and knows the use of every Wheel, takes notice of their Proportion, Contrivance, and Adaptation altogether, and of the hidden Springs that move them all: So in the World, though every Peruser may read the existence of a Deity, and be in his degree affected with what he sees, yet he is utterly unable to discern there those subtler Characters and Flourishes of Omniscience, which true Philosophers are sharp-sighted enough to discern. The existence of God is indeed so legibly written on the Creatures, that (as the Scripture speaks in another sense) *He may run that reads it*; that is, even a perfunctory Beholder, that makes it not his business, may perceive it: But that this God hath manifested in these Creatures a Power, a Wisdom, and a goodness worthy of himself, needs an attentive and diligent Surveyor to discover. How different notions of Gods Wisdom do the Eggs of Hens produce in the ordinary Eaters of them, and in Curious Naturalists, who carefully watch and diligently observe from time to time the admirable progress of Nature in the Formation of a Chick, from the first change appearing in the *Cicatricula* (or little whitish speck discernable in the Coat of the Eggs yolk) to the breaking of the Egg-shell by the perfectly hatched Bird, and on Natures exquisite method in the order and fashioning of the parts, make such Philosophical Reflections as You may meet with (not to mention what *Aristotle* and *Fabricius ab Aquapendente*, have observed on that subject) in the Ingenious Treatise of Generation, which our accurate and justly famous Anatomist, Dr. *Higmore*, has been pleased to Dedicate to me; and in the excellent Exercises

Hab. 2. 2.

tations

tions, *De Ovo*, of that great Promoter of Anatomical Knowledge, Dr. *Harvey*. And whereas it may be alledg'd, That the Attributes of God, which are not taught us, but after much speculation of the World, are things of which no man but an Atheist doubts; to this it may be replied, That besides that, it ill becomes the sense we ought to have of our weaknesse to despise any helps vouchsaf'd us of God to assist us to know or serve him; besides this, I say, God loving, as he deserves, to be honour'd in all our Faculties, and consequently to be glorified and acknowledged by the acts of Reason, as well as by those of Faith, there must be sure found a great Disparity betwixt that general, confus'd, and lazy Idea we commonly have of his Power and Wisdom, and the distinct, rational, and affecting notions of those Attributes which are form'd by an attentive inspection of those Creatures in which they are most legible, and which were made chiefly for that very end. The Queen of *Sheba* had heard in her own Countrey a very advantageous Fame of the Wisdom of *Solomon*; but when the Curiosity of a personal Visit made her an Eye-witnesse of those particular both exquisite Structures, and almost Divinely prudent Conducts and contrivances wherein that Wisdom did inimitably display it self, she then brake forth into Pathetick and Venerating Exclamations, that acknowledg'd how much juster and improved a character (of his Wisdom) her Eyes had now given her, than formerly her Ears had done.

Very like a Philosopher, me thinks, does the Great *Mercurius Trismegistus* (if we grant him to be the Author of the Books ascribed to him) speak, when he tels his Son, *There can be no Religion more true or just, than to know the things that are, and to acknowledg thanks for all things to him that made them; which things I shall not cease to do.* (He continues) *Be pious and religious, O my Son! for he that does so, is the best and highest Philosopher, and without Philosophy it is impossible ever to attain to the height and exactnesse of Piety and Religion.* And twas perhaps, *Pyrophilus*, to engage us to an in-

*Mere. Trism. l. 1.
Englished by
Dr. Everard.*

industrious indagation of the Creatures, that God made Man so indigent, and furnish'd him with such a multiplicity of Desires, so that whereas other Creatures are content with those few obvious and easily attainable necessities, that Nature has almost every where provided for them; in Man alone, every Sense has store of greedy Appetites, for the most part of Superfluities and Dainties, that to relieve his numerous Wants, or satisfy his more numerous Desires, he might be oblig'd with an inquisitive Industry to Range, Anatomize, and Ransack Nature, and by that concern'd Survey come to a more exquisite Admiration of the Omniscient Author. To illustrate this subject yet a litle further, *Pyrophilus*, give me leave to observe to You, That Philosophers of almost all Religions have been, by the contemplation of the World, mov'd to consider it under the notion of a Temple: *Ne adoremus* (sayes *Plutarch*) *Elementa, Cælum, Solem, Lunam, &c. specula sunt hac, in quibus artem illius singularem intueamur, qui mundum condidit, & adornavit; nec est alius Mundus quàm Templum ejus: Let us not venerate the Elements, the Heaven, the Sun, the Moon, &c. these are but Miroirs, wherein we may behold his excellent Art, who framed and adorn'd the World; nor is the World anything else but his Temple. Homines* (saies *Cicero*) *invenitur illum Globum, quem in Templo hoc medium vides, qui terra dicitur: Men abide upon that Globe which you see in the middle of this Temple, and is called the Earth: which Macrobius handsomely thus expounds: Quicquid humano aspectui subicitur, Templum ejus vocavit qui sola mente concipitur, ut qui hac veneratur ut Tempia, cultum tamen maximum debeat Conditori, sciatq; quisquis in usum Templi huius inducitur, ritu sibi vivendum Sacerdotis: All that humane view reaches, he terms his Temple, who is apprehended by the mind alone; to the end that who so reverences these things as Temples, might render the greatest worship to the Maker; and every one that is brought to converse in this Temple, might know himself oblig'd to live like a Priest.*

That Philosophers of all Religions have considered the world under the notion of Gods Temple.

And the lofty *Seneca* (to mention now no other Heathens) in diverse passages of his excellent Writings, styles the World a Temple; and I remember in his Treatise *De Beneficiis*, he avers in terms not unworthy his Mind or his Subject, *Totum Mundum Deorum esse immortalium Templum, solum quidem amplitudine illorum ac magnificentia dignum.* That the whole World is the Temple of the immortal Gods, being alone worthy of their Grandeur and Magnificence. The assent of the Jewish Philosophers to this Notion, you may be pleas'd to receive from their Eloquent *Philo*, who not onely gives the World the Name of Temple, but gives us this account of that appellation; *Templum Dei supremum & verè tale existimare totum hunc mundum, qui sacrarium quidem habet, purissimam rerum naturam partem, Cælum; ornamenta, stellas; sacerdotes, ministros potentia ejus, Angelos, & incorporeas animas.* The whole World is to be accounted the chiefest Temple of God; the Sanctum Sanctorum of it is of the purest part of the Universe, Heaven, the ornaments, the Stars; the Priests, the Ministers of his Power, Angels, and immaterial Souls. And as for Christian Philosophers, I suppose it would be needless to enumerate the passages wherein they adapt the Notion of the World already mention'd; and therefore I shall content my self to adde, that the Scripture it self seems to Authorise it by representing to us in the Eighth or Ninth Chapters of the Epistle to the Hebrewes, the Mosaical Tabernacle, as an adumbration of that great Temple of the World; and particularly there is a signal Text in the latter of those Chapters, where it is said that Christ is not enter'd into holy places made with Hands [*χειροποίητα ἁγια*] which are copies of the true, [*ἀντίτυπα τοῦ ἀληθινού,*] but into Heaven it self, now to appear in the presence of God for us.

Sen. lib. 7. c. 7.

Philo Jud. de Monarchia.

Heb. 8. 2, 5.

Heb. 9. 24.

Upon what account, *Pyrophilus*, I esteem the World a Temple, I may elsewhere have occasion to Declare; but this for the present: It will not be rash to inter, that if the World be a Temple, Man sure must be the Priest, ordain'd (by being

That in this Temple man must be the Priest.

qua-

qualified) to celebrate Divine Service not onely in it, but for it. For as in Schools, when the Prince or some munificent Benefactor confers some large possession or rich annuity upon the Foundation, though all the Boyes be concern'd in the Benefit, yet because most of them are too young to be sensible of it, or too unlearned to be able to make the retribution of a handsome acknowledgment, either the Master, or that other person of Society, who is most capable and the best Spokesman, is by a kind of natural right engag'd to the duty of returning praise and thanks, not for himself alone, but in the name of all the rest: So in the World, where there are so many inanimate and irrational Creatures, that neither understand how much they owe to their Creator, by owing him even themselves, nor are born to a condition inabling them to acknowledge it; Man, as born the Priest of Nature, and as the most oblig'd and most capable Member of it, is bound to returne Thanks and Praises to his Maker, not onely for Himself, but for the whole Creation. In which sense we may reconcile those two current Assertions, *That God made all things for His own Glory, and that God made all things for man, and Man for Himself.* Since whether or no Man be a Microcosme or Litle World in *Paracelsus's* sense, if not as a Resembler, yet as a Representer of the Macrocosme or Great World, he presents with his own Adorations the Homages of all the Creatures to their Creator, though they be ignorant of what is done, as Infants under the Law were of the Sacrifices offered on their account. And in this Relation may the Creatures answer the solemn invitation made them in the whole 148 *Psalm*, and numerous other Scriptures; which they may do (to borrow a barbarous but significant School-terme) objectively, though not formally; I mean, by proving occasions, though not fingers, of his Praises; and being such objects as prompt and invite Man to pay God that praise upon their score, which they cannot actually pay him themselves; even God's muteest works being capable of being said

to praise him in the same sense (though in an incomparably transcendent degree) that *Solomon* saies of his virtuous Woman (in the last Verse of the Proverbs) *Let her own Works Praise her in the Gates*; that is, give the considerers of them occasion to extol her: and thus by man's referring the knowledge of the Creature to the Caeator's Glory, it becomes in some sense, and congruously to its own Nature, the praiser of its Maker, as may seem intimated in this O Economy of the Last part of one of the *Psalmes*, *Blesse the Lord, all ye His Hosts, the Ministers of His that do His pleasure. Blesse the Lord all His Works, in all places of His Dominion: Blesse the Lord, O my Soule.* Where by shutting up the rest of God's Creatures betwixt Angels and Man's Soul, he seems to insinuate that the irrational Creatures blesse the Lord by the mouth of those that are Intelligent.

Prov. 31. 13.

Psal. 103.

And truly, *Pyrophilus*, I fear it may relish a little of selfishnesse, to make such a disparity betwixt Perfections, all of them equal, because all of them infinite, as to let God's mercy, because it most advantages us, so to ingrosse our thoughts, and wonder, as to make us neglect the contemplation of those other Glorious Attributes, his Power and his Wisdome, which were those that exacted both Man and Angels adoration, before sin gave occasion to the exercise of the first. And I shall not scruple to confesse unto you, that I dare not confine the Acts of Devotion to those which most men suppose to comprise the whole exercise of it; not that I at all undervalue, or would depreciate any, even the meanest practises of Devotion, which either Scripture or reason consonant to it recommends; but that I esteem that God may be also acceptably (and perhaps more nobly) serv'd and glorifi'd by our entertaining of high, rational, and as much as our nature is capable of worthy notions, attended with a profound and proportionable admiration of those divine Attributes and Prerogatives for whose manifesting he was pleas'd to construct this vast Fabrick.

The contemplation of Gods mercy ought not so to ingrosse our thoughts as to make us neglect the Glory of his Power and Wisdome.

To which purpose I consider, that in the Life to come, when we shall questionless glorifie God exactlyest, we shall have little either need or use of Faith, Prayer, Liberality, Patience, and resembling Graces; but our Worship will chiefly consist in elevated Notions, and a prostrate Veneration of Gods Omnipotence, Wisdom, Goodness, and other Perfections; and such a one as this is represented in the *Apocalyps*, to be the present employment of the blest Spirits in Heaven, where the Elders that assist about the Throne of God are describ'd, casting their Crowns before it, and saying to him that sits on it *Thou art worthy, O Lord, to receive Glory, and Honour, and Power: for thou hast created all things, and for thy pleasure they are and were created.*

Rev 4.11.

By this time, *Pyrophilus*, I hope you begin to think, that the Doctrine that tends to deter Men from enquiring into Nature, is as well derogatory from Gods Glory, as prejudicial to Mans interests. And indeed, I purpos'd to content my self with the having dispers'd throughout the past Discourse, the grounds of answering their Objection against the study of Physiology, who pretend it is apt to make Men Atheists: but because I am much concern'd to have you satisfied of so important a Truth, as that which we have hitherto been laboring to convince, I must beg your leave, *Pyrophilus* to adde *ex abundanti* (as they speak) to what has been already alledg'd, some things that may more directly answer the Objection of our Adversaries, and manifest how little their severity is befriended, either by Scripture, Reason, or Experience.

And first, it seems not at all probable, That if the Omniscient Author of Nature knew that the study of his Works did really tend to make Men dis-believe his Being or Attributes, he would have given Men so many Invitations, and almost Necessities, to study and contemplate the Nature of his Creatures: Of these Invitations divers have been mention'd already, and more might be added to them, if we thought it requisite. But what has been above alledg'd, will make us
forbear

forbear the annexing of any, save that of the ancient Institution of the Sabbath, which many eminent Divines do not groundlessly hold to have been ordain'd to commemorate the Creation, and give Men the opportunity every Seventh Day to contemplate God in his Workes, as he himselfe was pleas'd to rest on the first Seventh Day, and contemplate Himselfe in the workes of the first six. And though our Western Churches, for certain Reasons (not here to be inquir'd into) have long since disus'd the Solemnizing of the Saturday, and appointed the Sunday for the Celebration of both the Workes of the Redemption, and Creation of the World together; yet 'tis evident enough that the Primitive Christians did for the most part keep the Saturday as Holy-day, as well as the Sunday: For that ancient Book (whoever be resolv'd to have written it) which goes under the Name of *Clement's Constitutions*, affords us, among others, these two memorable Passages to our purpose: And first, τὸ Σάββατον μόντοι (sayes he) ἡ ἡμετέρα ἐορτάζεται ὡς τὸ μὲν ἀναμνηστικὸν τοῦ κατασκευασθέντος κόσμου, ἡ δὲ ἀναστάσεως. *Keep the Sabbath and the Lords Day as Holy-dayes; that being dedicated to the remembrance of the Creation, and this to that of the Redemption.* To which we shall adde this second Passage of the same Author, Ἐργαζέσθων οἱ δούλοι &c. *Let Servants work for five dayes; but on the Sabbath, and the Lords day, let them attend in the Church the Doctrine of Godliness.* To which purpose, I remember the most Learned *Grotius* observes, That the converted Emperor *Constantine*, forbad the compelling Christians to appear before Tribunals on either of those Dayes, as being their Festivals: Nay, and if Modern Travellers do not misinform me, I finde that divers of the Eastern Churches, particularly the *Abissine* Christians, to this day do as well sanctifie the Sabbath-day in Commemoration of Gods having created the World, as the Lords-day to commemorate the Resurrection of Christ. And as for the Jewes sense of the Fourth Commandement, some of the Learnedst of their Critics are pleas'd to distinguish betwixt the Words *Zachôr* and

Proved further from the ancient Institution of the Sabbath.

Lib. 7. c. 24.

See of the *Abys-
sine* or *Ethiopi-
an* Christians;
and likewise of
the *Maronites*
in the East, in
reference to
their Celebration
of the *Satur-
day*, *Alex.
Rossi* in his
view of all Re-
ligions, and the
Authors by him
cited.

Smor, Remember, and Keep, imploy'd in the Command of solemnizing the Sabbath: For, the remembring of it they hold to be an act of Religion, performable by all Man-kind that are capable of it, and acquainted with its having been commanded; though the keeping of it Holy they suppose onely enjoin'd to the *Israelites*: On which occasion I remember I was one Sabbath-day entertained at his own Lodgings, by a Learned Jew (who taught me the Holy Language) with Meat then newly dressed: to remove my wonder at which, he told me, *That it was dressed by Christians, who, being Gentiles, were not obliged to the strict and legall observation of the Sabbath.* But what ever be to be thought of this Jewish Notion, yet questionlesse if the Fourth Commandement do not, at least, divers other Passages of Scriptures do much discountenance their severity, who would fright Men from the indagation of Nature. And he that shall duly consider divers Texts obvious enough in the Book of *Job*, and the *Psalms* (besides other parts of the Bible) will not readily conclude, that Naturall Philosophy and Divinity are at such variance, as the Divines we deal with would perswade us. *St Paul* seems to inform us, that the invisible things of God from the Creation of the World, are cleerly seen, being understood by the things that are made, even *his Eternal Power and God-head*: So that they that were mention'd before are without excuse. And though I ignore not, that not onely several of the *Soci-nians* following their Master *Socinus*, but some few Orthodox Writers, are pleas'd to give a very differing Interpretation of that Text, and make the *ἀόρατα αὐτῶν θεοῦ τῆς αἰωνίου κτίσεως*, to signifie those things of God that have been Invisible ever since the Creation of the World, and referring the *κτίσματα* to things not made, as we Translate it, *but done* (as the Miracles of Christ and his Apostles) yet I see no necessity why the *κτίσματα* should be taken in a sense exclusive of the Creation, and not at least admitted to take in all the Wayes and Methods imployed by God to manifest the *invisible things* there intimated unto Man:

And

And certainly, however *St Paul* may be suppos'd to appear but darkly, yet *Job* was clearly of a differing Opinion from theirs, who teach, *That the Study of Nature leads to Atheism:* *For aske now the Beasts* (sayes he) *and they will teach thee, and the Fowles of the Aire, and they shall tell thee, or speake to the Earth, and it shall teach thee, and the Fishes of the Sea shall declare unto thee. Who knoweth not in all these that the hand of the Lord hath wrought this?* And consonantly hereunto (which 'twere not amisse for our Adversaries to take notice of) we may observe. That almost all the Writers of Natural Theology, and the most also of those that have laboured to demonstrate the Truth of Christian Religion (divers of whom have been as well Profound Divines, as otherwise Eminent Scholars) have undertaken to evince, by the consideration of the Universe, both that there is a God, and that he is the Author of it: which I the rather mention, *Pyrophilus*, because I would not be mistaken, as if I disputed against Divines in general, or were guilty of the least Irreverence towards a Faculty, in whose Study I have thought my selfe oblig'd, as a Christian, to spend much of my time; and especially, I would not appear dis-respectfull to Divines in *England*, where they have already been but too much vilified, though questionlesse for their sins against God, yet, I fear, not without the Sin of their Oppressors.

In the next place I consider, That since Physiology is said to tempt to Atheism, But by enabling Men to give an account of all the *Phænomena* of Nature, by the knowledge of Second Causes, without taking in the First, it will not be so easie a matter as many presume, for the contemplation of Nature, to turn a considering Man Atheist. For we are yet, for ought I can find, far enough from being able to explicate all the *Phænomena* of Nature by any Principles whatsoever. And even of the Atomical Philosophers, whose Sect seems to have the most ingeniously attempted it, some of

That Physiologists cannot explicate by second causes all the Phænomena of Nature so as to exclude the first.

the eminentest have themselves freely acknowledged to me, their being unable to do it convincingly to others, or so much as satisfactorily to themselves: And indeed, not onely the Generation of Animals is a Mystery, which all that Naturalists have said to explain it, have been far enough from depriving of that Name: but we see that to explicate, all the various *Phænomena* that belong to that single inanimate, and seemingly homogeneous Body, *Mercury*, so as not to make any *Hypothesis* assum'd to make out one of its Properties or Effects incongruous to any other *Hypothesis* requisite to the explanation of any of the rest, hath been hitherto found so difficult, that if our Posterity be not much happier Unriddlers, then our Fore-Fathers, or we have been, it is like to prove a Taske capable of defeating the Industry and Attempts, I say not of more then one Philosopher, but of more then one Age, even our Chymical Tortures hitherto, having, from that deluding *Proteus*, forc'd no Confessions that bring us not more Wonder then Satisfaction, and do not Beget almost as many Scruples as they Resolve.



ESSAY





ESSAY IV.

*Containing a requisite Digression concerning
those that would exclude the Deity from
intermedling with Matter.*

I Ignore not that not onely *Leucippus*, *Epicurus*, and other
Atomists of old, but of late some Persons, for the most
part Adorers of *Aristotle's* Writings, have pretended to
be able to explicate the first *Beginning of Things* and the
Worlds *Phænomena*, without taking in, or acknowledging
any Divine Author of it: And therefore, though we may
elsewhere, by the assistance of that Author have an oppor-
tunity to give You an Account of our unsatisfiedness with the
Attempts made by some bold Wits in favour of such Pretensi-
ons; Yet since the main Truth We plead for, in this Dis-
course, is so nearly concern'd in what hath been taught by those
that would keep God from being thought to have any share in
the Production of the Universe, I can scarce forbear (as un-
willing as I am to digress) to represent to You, on the present
occasion, a few Considerations which may assist You, if not
to lessen the Arrogance of such Persons, at least, to keep Your
self from thinking their Evidence as great as their Confidence
is wont to be. Now of the Philosophers we speak of, some
being Atomists; and others not, it will be requisite to say
something to each of the two sorts: And because we not long
since, in an Illustrious Company, where You, *Pyrophilus*, are
not unknown, met with one of them, who avowedly ground-
ed his Opinions on the *Aristotelean* or *Vulgar Physiology*, we
shall

*That some of the
Peripatetick sect
are guilty of this
endeavour.*

shall first recommend to You two or three Considerations concerning such arrogant Peripatericks (For I speak not of that Sect in general, of which I know there are divers excellent Men.)

That their Hypothesis is very full of mistakes.

First then, You will in many Passages of the following Essays, find, that divers things that have been very Magisterially taught, and confidently believ'd among the Followers of *Aristotle*, are Errors or Mistakes; and that as several, even of the obvious *Phænomena* of Nature, do contradict the common Peripatetick Doctrine, so divers, at least of those that are more abstruse, are not explicable by it; and as confidently as these his Followers talk of the expounding the very Riddles of Nature; yet I remember that he himself somewhere (for I cannot call to mind the place) did not scruple to confess, that *As the Eyes of Owls are to the splendor of the Day, so are those of our Minds even to things obvious and manifest.*

That these excluders of the Deity make but imperfect explanations of the Phænomena of Nature.

I shall next take notice, That Philosophers, who scorn to ascribe any thing to God, do often deceive themselves, in thinking they have sufficiently satisfied our Enquiries, when they have given us the nearest and most immediate causes of some things; whereas oftentimes the assignment of those Causes is but the manifesting that such and such Effects may be deduc'd from the more Catholick affections of things, though these be not unfrequently as abstruse as the *Phænomena* explicated by them, as having onely their Effects more obvious, not their Nature better understood: As when, for instance, an account is demanded of that strange supposed Sympathy betwixt Quick-silver and Gold; in that we find, that whereas all other Bodies swim upon Quick-silver, it will readily swallow up Gold, and hide it in its Bosome. This pretended Sympathy the Naturalist may explicate, by saying, That Gold being the onely Body heavier then Quick-silver of the same bulk, the known Lawes of the *Hydrostaticks* make it necessary; that Gold should sink in it, and all lighter Bodies swim on it: But though the cause of this Effect be thus plausibly assign'd,

by deducing it from so known and obvious an affection of Bodies, as Gravity, which every man is apt to think he sufficiently understands; yet will not this put a satisfactory period to a severe Inquirers Curiosity, who will, perchance, be apt to alledge, That though the Effects of Gravity indeed be very obvious, yet the Cause and Nature of it are as obscure as those of almost any *Phænomenon* it can be brought to explicate. And that therefore he that desires no further account, desists too soon from his enquiries, & acquiesces long before he comes to his Journeys end. And indeed, the investigation of the true nature and adequate cause of gravity, is a task of that difficulty, that in spite of ought I have hitherto seen or read, I must yet retain great doubts whether they have been clearly and solidly made out by any Man. And sure, *Pyrophilus*, there are divers Effects in Nature, of which though the immediate Cause may be plausibly assign'd, yet if we further enquire into the Causes of those Causes, and desist not from ascending in the Scale of Causes, till we are arriv'd at the top of it, we shall perhaps find the more Catholick and Primary causes of Things, to be either certain, primitive, general and fixt Laws of Nature (or rules of Action and Passion among the parcels of the Universal Matter,) or else the Shape, Size, Motion, and other primary Affections of the smallest parts of Matter, and of their first Coalitions or Clusters; especially those endow'd with Seminal Faculties or Properties, or (to dispatch) the admirable conspiring of the several parts of the Universe to the production of particular Effects; of all which it will be difficult to give a satisfactory Account, without acknowledging an intelligent Author or disposer of Things.

And the better to clear so weighty a Truth, let us further consider on this occasion, That not onely *Aristotle*, and those that, mis-led by his Authority, maintain the Eternity of the World, but very many other Philosophers and Physicians, who ascribe so much to Nature, that they will not be reduc'd to acknowledge an Author of it, are wont very much to delude

Physiologo qui
veritatem con-
templatur ulti-
māū causarum
cognitio non fi-
nis est, sed initi-
um ad primas
supremasq; cau-
sas proficiscen-
di. *Plutarch. l.*
de primo Frigi.
do.

Τὸ μέγιστον αὐ-
τὸν ἐστὶ τὸ ἐμπύ-
ρον ἰσχυρόν.
Aristot. Ethic.
Nicom. lib. 3.
cap. 8.

And do not ex-
plain the scale of
causes unto the
last cause.

Inq.

Instances of
things wherein
their account is
not satisfactory:
as 1. In the
particulars, the
Causes of which
they assign occult
Qualities.

both themselves and others in the account they presume to give us, as satisfactory, of the Causes or Reasons of very many Effects. I will not instance in the Magnetick Properties of Things, nor any of those numerous abstrusities of Nature, which tis well known that the *Aristotelians* are wont to refer to Sympathy, Antipathy, or Occult Qualities, and strive to put Men off with empty Names, whereby they do not so much lessen our Ignorance, as betray their own.

But I shall instance in those more obvious *Phænomena*, of which they suppose they have given us very satisfactory Accounts. If you ask one of those I speak of, whence it comes to pass, that if a man put one end of a long Reed into a Vessel full of Water, and suck at the other end, his mouth will be immediately fill'd with that Liquor; he will readily tell you, That the Suction drawing the Air out of the cavity of the Reed, the Water must necessarily succeed in the place deserted by the Air, to prevent a Vacuity abhorr'd by Nature. If you likewise ask such a Man, Why two Women, about a certain Age, their *Purgationes Menstruæ* do commonly supervene; he will think he has sufficiently answer'd you, when he has told you that about that Age, beginning to be ripe for Procreation, Nature has wisely provided that their superfluous blood should be sent to the Uterine Vessels, partly to disburthen the Masse of Blood of an uselesse load, and partly to contribute Matter, or at least afford Nourishment in case of Conception. But though these Solutions are wont to be acquiesc'd in by such as those that give them, yet I see not how they can satisfy a rigid Reasoner. For not now to mention what may be objected against them out of some modern Mechanical and Anatomical Observations, let us a litle consider, That to say that the ascent of the water in the first Problem, proceeds from Natures Detestation of a Vacuity, supposes that there is a kind of *Anima Mundi*, furnished with various Passions, which watchfully provides for the safety of the Universe; or that a Brute and inanimate Creature, as Water, not onely has a power to move its

2 When they assign Natures abhorrence of Vacuity to be the cause that Water doth ascend in Suction.

its heavy Body upwards, contrary (to speak in their language) to the tendency of its particular Nature, but knows both that Air has been suck'd out of the Reed, and that unless it succeed the attracted Air, there will follow a *Vacuum*; and that this Water is withall so generous, as by ascending, to act contrary to its particular inclination for the general good of the Universe, like a Noble Patriot, that sacrifices his private Interests to the publick ones of his Countrey.

But to shew men by an easie Experiment how little Attraction is perform'd to avoid a *Vacuum*, I have sometimes done thus. I have taken a slender Pipe of Glasse, of about four Foot long, and putting one of the open ends of it into a Vessel full of Quick-silver, I have suck'd as strongly as I could at the other, and caus'd one to watch the ascent of the Quick-silver, and mark where it was at the highest, and I found not that at one Suck I could raise it up much above a Foot; and having caus'd a couple of strong men, one after another, to suck at the same end of the same Pipe, I found not that either of them could draw it up much higher. Nor did it appear that by repeated Suctions, though the upper end of the Pipe were each time stop't, to hinder the relapse of the Quick-silver, it could at all be rais'd above the seven and twenty Digits, at which it us'd to subsist in the *Torricellian* Experiment *De Vacuo*: Whereas the same end of that Tube being put into a small Vessel of Water, I could at one Suck make the water swiftly ascend through the perpendicularly held Tube into my Mouth, which argues, that the ascension of Liquors upon suction, rather depends upon the pressure of the Air (against the Liquors and the Suckers Chest) and their respective measures of Gravity and Lightness compar'd to that Pressure, then it proceeds from such an abhorrency of a *Vacuum* as is presum'd.

And so likewise in the other question propos'd; it is imply'd, that there is in a female body something, that knows the rule of Physicians, That of a *Plethora*, the Cure is the convenient Evacuation of Blood, and that this Intelligent Faculty is wise e-

whereas the contrary is proved in the Suction of the Quick-silver.

3. When they assign the causes of the purgationes menstruae.

nough also to propose to it selfe the double end above mentioned, in this Evacuation, and therefore will not provide a quantity of blood great enough to require an Excretion, nor begin it till the Female be come to an Age, wherein tis possible for both the Ends to be obtain'd; and that also this presiding Nature is so charitable, as that mankind might not fail, it will make the Female subject to such Monethly superfluities of Blood, from which Experience informs us, that a whole Set of Diseases peculiar to that Sex, does frequently proceed. And in a word, there is a multitude of Problems, especially such as belong to the use of the parts of a humane Body, and to the Causes and Cures of the Diseases incident thereunto; in whose Explication those we write of, content themselves to tell us, That Nature does such and such a thing, because it was fit for her so to do; but they endeavour not to make intelligible to us what they mean by this Nature, and how meer, and consequently bruit, Bodies can act according to Laws, and for determinate Ends, without any knowledge either of the one or of the other. Let them therefore, till they have made out their *Hypothesis* more intelligibly, either cease to ascribe to irrational Creatures such Actions as in Men are apparently the productions of Reason and Choice, and sometimes even of Industry and Virtue; or else let them with us acknowledge, that such Actions of Creatures in themselves Irrational, are perform'd under the superintendence and guidance of a Wise and Intelligent Author of Things. But that you may not mistake me, *Pyrophilus*, it will be requisite for me, to acquaint You in two or three words, with some of my present thoughts concerning this subject: That there are some Actions so peculiar to Man, upon the account of his Intellect and Will, that they cannot be satisfactorily explicated after the manner of the Actions of meer-corporeal Agents, I am very much inclin'd to believe. And whether or no there may be some Actions of some other Animals, which cannot well be Mechanically explicated, I have not here leisure or opportunity to examine.

But

And when in other cases they ascribe to irrational Creatures such actions as in men are the productions of Reason and Choice.

But for (most of) the other *Phænomena* of Nature, me thinks we may, without absurdity conceive, That God, of whom in the Scripture tis affirm'd, *That all his works are known to him from the beginning*, having resolv'd, before the Creation, to make such a World as this of Ours, did divide (at least if he did not create it incoherent) that Matter which he had provided, into an innumerable multitude of very variously figur'd Corpuscles, and both connect'd those Particles into such Textures or particular Bodies, and plac'd them in such Situations, and put them into such Motions, that by the assistance of his ordinary preserving Concourse, the *Phænomena*, which he intended should appear in the Universe, must as orderly follow, and be exhibited by the Bodies necessarily acting according to those Impressions or Laws, though they understand them not at all, as if each of those Creatures had a Design of Self-preservation, and were furnish'd with Knowledge and Industry to prosecute it; and as if there were diffus'd through the Universe an intelligent Being, watchful over the publick Good of it, and careful to Administer all things wisely for the good of the particular Parts of it, but so far forth as is consistent with the Good of the Whole, and the preservation of the Primitive and Catholick Lawes established by the Supreme Cause: As in the formerly mention'd Clock of *Stratsburg*, the several pieces making up that Curious Engine, are so fram'd and adapted, and are put into such a motion, that though the numerous Wheels, and other parts of it, move several wayes, and that without any thing either of Knowledge or Design; yet each performs its part in order to the various Ends for which it was contriv'd, as regularly and uniformly as if it knew and were concern'd to do its Duty; and the various motions of the Wheels, and other parts concur to exhibit the *Phænomena* design'd by the Artificer in the Engine, as exactly as if they were animated by a common Principle, which makes them knowingly conspire to do so, and might, to a rude *Indian*, seem to be more intelligent than

AAs 15. 18.

The Authors conceits concerning Gods Creation of the parts of the world, and so placing them, that they (by the assistance of his ordinary Concourse) must needs exhibit these Phænomena.

Illustrated by the Motions of the Clock at Stratsburg,

Conradus Diasypodius himself, that published a Description of it, wherein he tels the World, That he contrived it, who could not tell the hours, and measure time so accurately as his Clock. And according to this Notion, if you be pleas'd to bear it in your memory, *Pyrophilus*, you may easily apprehend in what sense I use many common Phrases, which custom hath so authorized, that we can scarce write of Physiologial Subjects, without employing either of them, or frequent and tedious Circumlocutions in their stead. Thus when I say, that a stone endeavors to descend towards the Centre of the Earth, or that being put into a Vessel of Water, it affects the lowest place: I mean, that not such a Mathematical point as the Centre of the Earth, hath power to attract all heavy Bodies, the least of which, it being a point, it cannot harbor; or that a Stone does really aim at that unknown and unattainable Centre; but that, as we say, that a Man strives or endeavors to go to any place, at which he would quickly arrive, if he were not forcibly hindered by some Body that holds him fast where he is, and will not let him go. So a Stone may be said to strive to descend, when either by the Magnetical Steams of the Earth, or the pressure of some subtle Matter incumbent on it, or by what ever else may be the cause of Gravity, the Stone is so determined to tend downwards, that if all impediments, interpos'd by the neighbouring Bodies, were removed, it would certainly and directly fall to the Ground; or being put into a Vessel with Water, or any other Liquor much lesse heavy than it self (for on Quick-silver, which is heavier, Stones will swim) the same Gravity will make it subside to the bottom of the Vessel, and consequently thrust away its bulk of water, which though heavy in it self, yet because it is lesse ponderous than the Stone, seems to be light. And so in our late instance in the Clock, if it be said that the Hand that points at the hours affects a circular motion, because it constantly moves round the Centre of the Dial-plate, tis evident that the inanimate piece of Metal affects not that motion more than any other, but onely that the

*How far such
borrowed and
Metaphorical
Phrases which
Custom has au-
thorized may be
used.*

*Quicksilver be-
ing heavier than
stones, they swim
thereon, yet sink
in lighter liquors*

impression it receives from the Wheels, and the adaptation of the rest of the Engine, determine it to move after that manner. And though if a man should with his finger stop that Index from proceeding in its course, it may be said, in some sense, that it strives or endeavours to prosecute its former Circular Motion; yet that will signifie no more, than that by virtue of that Contrivance of the Engine, the Index is so impell'd, that if the Obstacle, put by the Finger of him that stops it, were taken away, the Index would move onwards, from that part of the Circle where it was stop'd, towards the mark of the next Hour. Nor do I by this, *Pyrophilus*, deny that it may in a right sense be said, as it is wont to be in the Schools, that *Opus Naturæ est opus Intelligentiæ*: Neither do I reject such common Expressions as *Nature alwaies affects and intends that which is best*, and *Nature doth nothing in vain*. For since I must, according to the above mention'd Notion, refer many of the actions of irrational Creatures to a most wise Disposer of Things, it can scarce seem strange to me, that in those particulars in which the Author intended, as it was requisite that irrational Creatures should operate so and so for their own Preservation, or the Propagation of their Species, or the publick good of the Universe, their Actions being ordered by a Reason transcending Ours, should not onely oftentimes resemble the Actings of Reason in us, but sometimes even surpass them. As in effect we see that Silk-worms and Spiders can, without being taught, spin much more curiously their Balls and Webs, than our best Spinsters could; and that several Birds can build and fasten their Nests more Artificially than many a Man, or perhaps any man could frame and fasten such litle and elaborate Buildings. And the Industries of Foxes, Bees, and divers other Beasts, are such, that tis not much to be wondered at that those creatures should have Reason ascrib'd to them by divers Learned men: who yet perhaps would be lesse confident, if they considered how much may be said for the Immortality of all Rational Souls, and that the

subtle

That the instances of the Actions of divers Creatures resembling Reason commend the Wisdom of God.

subtle Actings of these Beasts are determin'd to some few particulars requisite for their own Preservation, or that of their Species; whereas on all other occasions, they seem to betray their want of Reason, and by their Voice and Gestures seem to expresse nothing, but the Natural Passions, and not any Rational or Logical Conceptions. And therefore, as when (to resume our former comparison) I see in a curious Clock, how orderly every Wheel and other parts perform its own Motions, and with what seeming Unanimity they conspire to shew the Hour, and accomplish the other Designs of the Artificer, I do not imagine that any of the Wheels, &c or the Engine it self is endowed with Reason, but commend that of the Work man who fram'd it so Artificially. So when I contemplate the Actions of those several Creatures that make up the World, I do not conclude the inanimate Pieces, at least, that tis made up of, or the vast Engine it self, to act with Reason or Design, but admire and praise the most wise Author, who by his admirable Contrivance can so regularly produce Effects, to which so great a number of successive and conspiring Causes are requir'd.

And thus much, *Pyrophilus*, having been represented concerning those, that rejecting from the Production and Preservation of Things all but Nature, yet imbrace the Principles of the vulgar Philosophy, you will perhaps think it more than enough: but object, That what is not to be expected from the barren Principles of the Schools, may yet be perform'd by those Atomical ones which we our selves have within not very many Pages seem'd to acknowledg Ingenious. And I know indeed, that the modern Admirers of *Epicurus* confidently enough pretend, that he and his Expositors have already, without being beholden to a Deity, clearly made out, at least the Origine of the World, and of the principal Bodies tis made up of: But I confesse, I am so far from being convinc'd of this, that I have been confirm'd rather, than unsetled in my Opinion of the difficulty of making out the Original of the World, and

and of the Creatures, especially the living Ones that compose it, by considering the accounts which are given us of the Nativity (if I may so speak) of the Universe, and of Animals, by those great Denyers of Creation and Providence, *Epicurus*, and his Paraphrast *Lucretius*: Whose having shown themselves (as I freely confesse they have) very subtile Philosophers in explicating divers Mysteries of Nature, ought not so much to recommend to us their impious Errors, about the Original of Things, as to let us see the necessity of ascribing it to an Intelligent Cause. This then is the account of this matter, which is given us by *Epicurus* himself, in that Epistle of his to *Herodotus*, which we find in *Diogenes Laertius*: *Quod ad Meteora attinet existimari non oportet, aut motum, aut conversionem, aut Eccipsin, aut ortum occasumvè, aut alia hujuscemodi ideo fieri quod sit Praefectus aliquis, qui sic disponat, disposueritvè ac simul beatitudinem immortalitatèmq; possideat*: And having interposed some Lines, to prove that the Providence of God is not consistent with his Felicity, he adds, *Quare opinandum est, tum cum Mundus procreatus est, factos fuise eos circumplexus convolventium se Atomorum, ut nata fuerit hac necessitas, quâ circuitus tales obierint*: And elsewhere in the same Epistle, *Infiniti* (saies he) *sunt mundi, alii similes isti, alii vero dissimiles. Quippe Atomi cum sint infiniti, ut non multo ante demonstratum est per infinitatem spatorum, & alibi alia, ac procul ab hoc ad fabrefactionem Mundorum infinitorum variè concurrant*. And least this Epicurean Explication of the Worlds Original should seem to owe all its unsatisfactori- nesse to its obscure brevity, we shall not scruple to give you that elegant Paraphrase and Exposition of it, which *Lucretius* has delivered in his 5th Book, *De Rerum Natura*:

Defects in the
Explication of
Nature by the
Epicureans who
deny the concu-
rence of God.

*Sed quibus ille modis, conjectus, materiai
Fundarit Cælum, ac Terram Pontiç, profunda
Solis, Lunæ cursus ex ordine ponam,
Nam certe neque conciliis primordia rerum*

•L

Ordine

*Ordine se quaque atque sagaci mente locarunt;
 Nec quos quaque darent motus pepigere profecto:
 Sed quia multa modis multis primordia rerum
 Ex infinito jam tempore percita plagis,
 Ponderibusque suis, consuerunt concita ferri,
 Omnimodisque coire, atque omnia pertentare,
 Quaecunque inter se possent congressa creare;
 Propterea fit, ut magnum volgata per ævum,
 Omnigenos cætus & motus experiundo,
 Tandem conveniant: ea qua conjuncta repente
 Magnarum rerum fiant exordia sæpè
 Terrarum maris, & cæli generisque animantium.*

The *Hypothesis* express'd in these Verses (which please our Author so well, that he has almost the same Lines in severall other places of his Poem (he prosecutes and applies to some particular parts of the Universe in the same 5th Book : But whilst he thus refuseth to allow God an Interest in the Worlds production, his *Hypothesis* requires that we should allow him several things, which he doth assume, not prove: As First, That Matter is Eternal. 2. That from Eternity it was actually divided, and that into such insensibly small parts, as may deserve the name of Atoms; whereas it may be suppos'd, that Matter, though Eternal, was at first one coherent Mass, it belonging to Matter to be divisible, but not so of necessity, to be actually divided. 3. That the number of these Atoms is really infinite. 4. That these Atoms have an *inane Infinitum* (as the Epicureans speak) to move in. 5. That these Atoms are endowed with an almost infinite variety of determinate Figures, some being round, others cubical, others hooked, others conical, &c. whereas not to mention beforehand what we may elsewhere Obbjeçt, besides against this Assumption, he shews not why, nor how this Atome came to be Spherical rather then Conical, and another Hooked rather then Pyramidal: But these Assumptions I insist not on, because of

two others much more considerable, which our Author is fain to take for granted in his *Hypothesis*: For 6ly, He supposes his Eternal Atoms to have from Eternity been their own Movers, whereas it is plain that Motion is no way necessary to the Essence of Matter, which seems to consist principally in Extension: For Matter is no lesse Matter, when it rests, then when it is in Motion; and we daily see many parcels of Matter passe from the state of motion to that of rest, and from this to that, communicating their motion to Matter that lay still before, and thereby loosing it themselves. Nor has any Man, that I know, satisfactorily made out how Matter can move it self: And indeed, in the Bodies which we here below converse withall, we scarce find that any thing is mov'd but by something else; and even in these motions of Animals that seem spontaneous, the Will or Appetite doth not produce the motion of the Animal, but guide and determine that of the Spirits, which by the Nerves move the Muscles, and so the whole Body, as may appear by the wearinesse and unweildinesse of Animals, when by much motion the Spirits are spent. And accordingly I find that *Anaxagoras*, though he believed, as *Aristotle* did after him, that Matter was Eternal, yet he discern'd that the notion of Matter not necessarily including motion, there was a necessity of taking in a *Mens*, as he stiles God, to set this sluggish Matter a moving. And I remember *Aristotle* himself, in one place of his *Metaphysicks*, disputing against some of the antienter Philosophers, asks, *Quonamque modo movebuntur si nulla erit ætterna causa? non enim ipsa materia seipsam movebit* ἀναγκαστικὴν rerum opifex *Virtus*: *Aristot. Metaphys. lib. 12. c. 6.* But though elsewhere I have met with Passages of his near of kin to this, yet he seems not to expresse his Opinion uniformly and clearly enough to engage mee to define it, or make a Weapon of it: And therefore I shall rather proceed to take notice, That according to the Epicurean *Hypothesis*, not only the motion, but the determination of that motion is supposed. For *Epicurus* will have his Atoms move downwards, and that

not in paralel Lines, lest they should never meet to constitute the World, but according to Lines somewhat inclining towards one another; so that there must be not onely motion, but gravity in Atoms, before there be any Centre of gravity for them to move towards; and they must move rather downwards then upwards, or sidewaies, and in such Lines as nothing is produc'd capable of confining them to. Which are Assumptions so bold and precarious, that I finde some, even of his Admirers, to be asham'd of them: Which will save me the labor of arguing against them, and allow mee to take notice in the seventh place, That this Epicurean Doctrine supposes that a sufficient number of Atoms, and their motion downwards being granted, there will need nothing but their fortuitous concurrence in their fall, to give a BEEING to all those Bodies that make up the World. Indeed, that the various coalitions of Atoms, or at least small Particles of Matter, might have constituted the World, had not been perhaps a very absurd Opinion for a Philosopher, if he had, as Reason requires, suppos'd that the great Masse of lazy Matter was Created by God at the Beginning, and by Him put into a swift and various motion, whereby it was actually divided into small Parts of severall Sizes and Figures, whose motion and crossings of each other were so guided by God, as to constitute, by their occurrences and coalitions, the great inanimate parts of the Universe, and the seminal Principles of animated Concretions. And therefore I wonder not much that the *Milesian Thales* (the first of the Grecian Philosophers (as *Cicero* informs us) that inquir'd into these matters) should hold that Opinion which *Tully* expresses in these Words: *Aquam dixit esse initium rerum, Deum autem eam Mentem quæ ex aqua cuncta finxerat*: And that of *Anaxagoras*, the same Author should give us this account, *Omnium rerum descriptionem & modum mentis infinite vi ac ratione designari & confici voluit*: For though these great Men exceedingly err'd, in thinking it necessary that God should be provided of a pre-existent, and by him not

crea-

De Nat. Deorum, lib. 1.

Idem ibidem.

created Matter to make the World of, yet at least they discern'd and acknowledg'd the necessity of a Wise and Powerful Agent to dispose and fashion this rude Matter, and contrive it into so goodly a Structure, as we behold, without imagining with *Epicurus*, that chance should turn a Chaos into a World. And really it is much more unlikely, that so many admirable Creatures that constitute this one exquisite and stupendous Fabrick of the World should be made by the casual confluence of falling Atoms, jostling or knocking one another in the immense vacuity, then that in a Printers Working-house a multitude of small Letters, being thrown upon the Ground, should fall dispos'd into such an order, as clearly to exhibit the History of the Creation of the World, describ'd in the 3 or 4 first Chapters of *Genesis*, of which History, it may be doubted whether chance may ever be able to dispose the fallen Letters into the Words of one Line. I ignore not that sometimes odde Figures, and almost Pictures may be met with, and may seem casually produc'd in Stones, and divers other inanimate Bodies: And I am so far from denying this, that I may elsewhere have opportunity to shew You, that I have been no careless Observer of such Varieties.

But first, even in divers Minerals; as we may see in Nitre, Chrystal, and several others, the Figures that are admired are not unquestionably produc'd by chance, but perhaps by something analogous to seminal Principles, as may appear by their uniform regularity in the same sort of Concretion, and by the practice of some of the skillfullest of the Salt peter Men, who when they have drawn as much Nitre as they can out of the Nitrous Earth, cast not the Earth away, but preserve it in heaps for six or seven Years; at the end of which time, they find it impregnated with new Salt-peter, produced chiefly by the seminal Principle of Nitre implanted in that Earth. To prove that Metalline Bodies were not all made at the beginning of the World, but have some of them a Power, though slowly to propagate their Nature when they meet with a dis-

That the figures in Nitre, Chrystal, and divers Minerals are produced, not by chance, but by somewhat analogous to seminal principles.

posed Matter; you may find many notable Testimonies and Relations in a little Booke of *Physico-Chymical Questions*, Written by *Fo. Conradus Gerhardus*, a Germane Doctor, and most of them recited (together with some of his owne) by the Learned *Senertus*: But lest you should suspect the Narratives of these Authors, as somewhat partial to their Fellow Chymists Opinions, I shall here annex that memorable Relation which I find recorded by *Linschotten*, and *Garcia ab Horto*, a pair of unsuspected Writers in this case concerning Diamonds, whereby it may appear that the seminall Principles of those precious Stones, as of Plants, are lodg'd in the Bowels of the Mine they grow in: *Diamonds* (sayes the first, in that Chapter of his Travels, where he Treats of those Jewels) *are digg'd like Gold out of Mines, where they digg'd one year the length of a Man into the Ground, within three or foure years after there are found Diamonds againe in the same place, which grow there; sometimes they finde Diamends of 400 or 800 Grains.* *Adamantes* (sayes the latter) *qui altissimè in terra visceribus, multisq; annis perfici debebant in summo fere solo generantur & duorum aut trium annorum spatio perficiuntur: Nam si in ipsa fodina hoc anno ad cubiti altitudinem fodias Adamantes reperies. Post biennium rursus illic excavato ibidem, invenies Adamantes.* And next, how inconsiderable, alas, are these supposed Productions of Chance, in comparison of the elaborate Contrivances of Nature in Animals? since in the Body of Man, for instance, of so many hundred Parts it is made up of, there is scarce any that can be either left out, or made otherwise then as it is, or placed elsewhere then where it is, without an apparent detriment to that curious Engine; some of whose parts, as the Eye, and the valves of the Veins, would be so unfit for any thing else, and are so fitted for the uses that are made of them, that 'tis so far from being likely that such skilfull Contrivances should be made by any Being not intelligent, that they require a more then ordinary Intelligence to comprehend how skilfully they are made.

*Sempl. in India
nascenti. lib. 1.
cap. 47.*

*That the genera-
tion of Animals
is much lesse to
be accounted the
production of
Chance.*

As for the account that *Zucretius*, out of *Epicurus*, * *Tanta ergo qui videat, & talia*
 gives us of the first Production of Men, in I know *potest exanimare nullo affectu*
 not what Wombs adhering to the Ground, and *esse consilio, nulla providentia,*
 which much more becomes him as a Poet, then as *nulla ratione divina, sed ex ato-*
 a Philosopher, I shall not here waste time to man- *mis subtilibus exiguis concreta*
 nifest its unlikeliness, that witty Father *Lactan-* *esse tanta miracula? Nonne*
tius having already done that copiously for me. *prodigio simile est, aut natum*
 And indeed it seems so pure a Fiction, That, were it *esse hominem qui hæc diceret,*
 not that the *Hypothesis* he took upon him to main- *ut Lucippum, aut extitisse qui*
 tain, could scarce afford him any lesse extravagant *crederet, ut Democritum, qui*
 account of the Original of Animals, the unsuitableness *auditor ejus fuit, vel Epicurum*
 of this *Romance*, to those excellent Notions with which he has *in quem vanitas omnis de Lu-*
 enriched divers other parts of his Works, would make me *cippi fonte profluxit, lib. 2 c. 11,*
 apt to suspect, that when he writ this part of his Poem, he
 was in one of the Fits of that Phrensie, which some, even of
 his Admirers, suppose him to have been put into by a Philtre
 given him by his either Wife, or Mrs *Lucillia*, in the Intervals
 of which, they say, that he writ his Books:

And here let us further consider, That as confidently as *That the Hypo-*
 many Atomists, and other Naturalists, presume to know the *theses of Philo-*
 true and genuine Causes of the Things they attempt to expli- *sophy only shew*
 cate; yet very often the utmost they can attain to in their Ex- *that an effect*
 plications, is, That the explicated *Phænomena* May be produc'd *May be produces,*
 after such a Manner as they deliver, but not that they really *by such a cause;*
 are so: For as an Artificer can set all the Wheels of a Clock *not that it must.*
 going, as well with Springs as with Weights, and may with
 violence discharge a Bullet out of the Barrel of a Gun, not
 onely by means of Gunpowder, but of compress'd Air, and
 even of a Spring. So the same Effects may be produc'd by
 divers Causes different from one another; and it will often-
 times be very difficult, if not impossible for our dim Reasons
 to discern surely which of these several wayes, whereby it is
 possible for Nature to produce the same *Phænomena* she has re-
 ally made use of to exhibit them. And sure, he that in a skil-
 ful Watch-makers Shop shall observe how many several wayes
 Watches

a Watches and Clocks may be contriv'd, and yet all of them
 shew the same things, and shall consider how apt an ordinary
 Man, that had never seen the inside but of one sort of Watches,
 would be, to think that all these are contriv'd after the same
 manner, as that whose Fabrick he has already taken notice of;
 such a Person, I say, will scarce be backward to think that
 so admirable an Engineer as Nature, by many pieces of her
 Workmanship, appears to be, can, by very various and dif-
 fering Contrivances, perform the same things; and that it is
 a very easie mistake for Men to conclude, that because an Ef-
 fect may be produc'd by such determinate Causes, it must be
 so, or actually is so. And as confident as those we speak of
 use to be, of knowing the true and adequate Causes of Things,
 yet *Epicurus* himself, as appears by ancient Testimony, and
 by his own Writings, was more modest, not onely contenting
 himself, on many occasions, to propose several possible ways
 whereby a *Phænomenon* may be accounted for, but sometimes
 seeming to dislike the so pitching upon any one Explication,
 as to exclude and reject all others: And some Modern Philo-
 sophers that much favor his Doctrine, do likewise imitate his
 Example, in pretending to assign not precisely the true, but
 possible Causes of the *Phænomenon* they endeavor to explain.
 And I remember, that *Aristotle* himself (what ever confi-
 dence he sometimes seems to express) does in his first Book
 of *Meteors* ingeniously confess, that concerning many of Na-
 tures *Phænomena*, he thinks it sufficient that they may be so
 perform'd as he explicates them. But granting that we did
 never so certainly know in the general that these *Phænomena* of
 Nature must proceed from the Magnitudes, Figures, Moti-
 ons, and thence resulting Qualities of Atoms, yet we may be
 very much to seek as to the particular Causes of this or that
 particular Effect or Event: For it is one thing to be able to
 shew it possible for such and such Effects to proceed from the
 Various Magnitudes, Shapes, Motions, and Concretions of
 Atoms, and another thing to be able to declare what precise,

That to a perfect
 knowledge there
 must not only ap-
 pear the possible,
 but the definite,
 and real, not only
 the General, but
 the Particular
 Causes.

and determinate Figures, Sizes, and Motions of Atoms, will suffice to make out the propos'd *Phænomena*, without incongruity to any others to be met with in Nature: As it is one thing for a Man ignorant of the Mechanicks to make it plausible, that the Motions of the fam'd Clock at *Stratsburg* are perform'd by the means of certain Wheels, Springs, and Weights, &c. and another to be able to describe distinctly the Magnitude, Figures, Proportions, Motions, and (in short) the whole Contrivance either of that admirable Engine, or some other capable to perform the same things.

Nay, a Lover of disputing would proceed farther, and question that way of Reasoning, which even the eminentest Atomists are wont to imploy to demonstrate that they explicate things aright.

For the grand Argument by which they use to confirm the truth of their Explications, is, That either the *Phænomenon* must be explicated after the manner by them specified, or else it cannot at all be explicated intelligibly: In what Sense we disallow not, but rather approve this kind of Ratiocination, we may elsewhere tell you. But that which is in this place more fit to be represented, is, That this way of arguing seems not in our present case so Cogent, as they that are wont to employ it think it to be: for besides that, it is bold to affirm, and hard to prove that What they cannot yet explicate by their Principles, cannot possibly be explicated by any other Men, or any other Philosophy; besides this, I say, that which they would reduce their Adversaries to, as an Absurdity, seems not to deserve that name: For supposing the Argument to be conclusive, That either the propos'd Explication must be allow'd, or Men can give none at all that is intelligible, I see not what absurdity it were to admit of the consequence. For who has demonstrated to us, That Men must be able to explicate all Natures *Phænomena*, especially since divers of them are so abstruse, that even the Learnedst Atomists scruple not to acknowledge their being unable to give an account of them.

Some defects in the wayes of Reasoning used by the most eminent Atomists:

And how will it be prov'd that the Omniscient God, or that admirable Contriver, Nature, can exhibit *Phænomena* by no wayes, but such as are explicable by the dimme Reason of Man? I say Explicable, rather than Intelligible; because there may be things, which though we might understand well enough, if God, or some more intelligent Being than our own, did make it his Work to inform us of them, yet we should never of our selves find out those Truths. As an ordinary Watch-maker may be able to understand the curiousest Contrivance of the skilfullest Artificer, if this Man take care to explain his Engine to him, but would never have understood it if he had not been taught: Whereas to explicate the Nature and Causes of the *Phænomena* we are speaking of, we must not onely be able to understand, but to investigate them.

And whereas it is peremptorily insisted on by some Epicureans, who thereby pretend to demonstrate the excellency and certainty of their Explications, that according to them, Nature is declar'd to produce things in the way that is most facile and agreeable to our Reason: It may be replied, That what we are to enquire after, is, how Things have been, or are really produced, not whether or no the manner of their Production be such, as may the most easily be understood by us: For if all things were, as those we reason withall maintain, casually produced, there is no reason to imagine that Chance considered what manner of their Production would be the most easily intelligible to us. And if God be allowed to be, as indeed he is, the Author of the Universe, how will it appear that He, whose Knowledge infinitely transcends ours, and who may be suppos'd to operate according to the Dictates of his own immense Wisdom, should, in his Creating of things, have respect to the measure and ease of Humane Understandings, and not rather, if of any, of Angelical Intellects, so that whether it be to God or to Chance, that we ascribe the Production of things, that way may often be fittest or likeliest for Nature to work by, which is not easiest for us to understand.

And

And as for the way of arguing, so often employ'd (especially against the Truth we now contend for) and so much rely'd on by many modern Philosophers, namely, That they cannot clearly conceive such or such a thing propos'd, and therefore think it fit to be reject'd; I shall readily agree with them in the not being forward to assent to any thing, especially in Philosophy, that cannot well be conceiv'd by knowing and considering Men: But there is so much difference among Men, as to their faculty of framing distinct Notions of things, and through mens partiality or laziness, many a particular Person is so much more apt, than these Men seem to be aware of, to think, or at least, to pretend, that he cannot conceive, what he has no mind to assent to, that a man had need be wary how he rejects Opinions, that are impugn'd onely by this way of Ratiocination: By which, I hope, it will not be expected that we should be more prevail'd with, than that Sect of Philosophers that employes it most. And among those that resolve the *Phænomena* of Nature into the Mechanical powers of Things, or the various Figures, Sizes and Motions of the parts of Matter, I meet with some, as the *Epicureans*, who tell us, They cannot frame a Notion of an Incorporeal Substance or Spirit, nor conceive how, if the Soul were such, it could act upon the Body: And yet others, that seem no lesse speculative, seriously and solemnly profess, That they can conceive a clear and distinct Notion of a Spirit, which they believe the humane Soul, that regulates at least, if not produces divers Motions of the Body, to be; denying on the other side, That it can be clearly conceiv'd, either that any thing that is onely material can think, or that there can possibly be any *Vacuum* (that is, place without any Body) in the Universe; both which the *Epicureans* profess themselves not onely to conceive as Possible, but believe as True.

And thus much, *Pyrophilus*, it may suffice to have said in relation to those who would reject God from having any thing to do, either in the Production or Government of the World,

The most plausible argument of the Opposers of a Deity considerd.

upon this ground, that they, if you will believe them, can explicate the Original and *Phanomena* of it without him; but tis not all, nor the greatest part of the Favorers of the Atomical Philosophy, that presume so much of themselves, and derogate so much from God: To say therefore something to the more moderate and judicious of that Perswasion, we will candidly propose on their behalf the most plausible Objection we can foresee against the Truth we have been all this while pleading for. They may then thus argue against us, That though the Atomists cannot sufficiently demonstrate from what Natural Causes every particular Effect proceeds, and satisfactorily explicate after what determinate manner each particular *Phanomenon* is produc'd; yet it may suffice to take away the necessity of having recourse to a Deity, that they can make out in general, That all the things that appear in the World, may, and must be perform'd by meerly corporeal Agents; or, if you please, That all Natures *Phanomena* may be produc'd by the parcels of the great Masse of Universal Matter, variously shap'd, connected, and moved. As a Man that sees a screw'd Gun shot off, though he may not be able to describe the number, bignesse, shape, and coaptation of all the pieces of the Lock, Stock, and Barrel, yet he may readily conceive that the Effects of the Gun, how wonderful soever they may seem, may be perform'd by certain pieces of Steel or Iron, and some parcels of Wood, of Gun-powder, and of Lead, all fashion'd and put together according to the exigency of the Engine, and will not doubt, but that they are produc'd by the power of some such Mechanical Contrivance of things purely Corporeal, without the assistance of spiritual or supernatural Agents.

In answer to this Objection, I must first profess to You, That I make great doubt whether there be not some *Phanomena* in Nature, which the Atomists cannot satisfactorily explain by any Figuration, Motion, or Connection of material Particles whatsoever: For some Faculties and Operations of
the

the reasonable Soul in Man, are of so peculiar and transcendent a kind, that as I have not yet found them solidly explicated by corporeal Principles, so I expect not to see them in haste made out by such. And if a spiritual Substance be admitted to enter the Composition of a Man, and to act by and upon his Body; besides that, one of the chief and fundamental Doctrines of the *Epicureans* (namely, That there is nothing in the Universe but *Corpus* and *Inane*) will thereby be subverted; it will appear that an Incorporeal and Intelligent Being may work upon Matter, which would argue, at least a possibility that there may be a spiritual Deity, and that he may intermeddle with, and have an influence upon the Operations of things Corporeal. But to insist no longer on this, let us give a further and direct Answer to the propos'd Objection, by representing, That although as things are now established in the world, an Atomist were able to explain the *Phænomena* we meet with, by supposing the parts of Matter to be of such Sizes, and such Shapes, and to be mov'd after such a manner as is agreeable to the Nature of the particular *Phænomenon* to be thereby exhibited, yet it would not thence necessarily follow, That at the first production of the World, there was no need of a most powerful and intelligent Being to dispose that *Chaos* or confus'd heap of numberless Atoms into the World, to establish the universal and conspiring Harmony of things; and especially to connect those Atoms into such various seminal Contextures, upon which most of the more abstruse Operations, and elaborate Productions of Nature appear to depend. For many things may be perform'd by Matter variously figur'd and mov'd, which yet would never be perform'd by it, if it had been still left to it self without being, at first at least, fashion'd after such a manner, & put into such a motion by an Intelligent agent. As the quill that a Philosopher writes with, being dipt in Ink, & then mov'd after such & such a manner upon white Paper, all which are Corporeal things, or their motions may very well

well trace an excellent and rational Discourse; but the Quill would never have been mov'd after the requisite manner upon the Paper, had not its motion been guided and regulated by the Understanding of the Writer. Or rather, yet once more to resume our former Example of the *Stratzbourg* Clock, though a skillful Artift, admitted to examine and confider it, both without and within, may very well discern that fuch Wheels, Springs, Weights, and other pieces of which the Engine confifts, being fet together in fuch a coaptation, are fufficient to produce fuch and fuch Motions, and fuch other Effects as that Clock is celebrated for, yet the more he difcerns the aptnefs and fufficiency of the parts to produce the Effects emergent from them, the leffe he will be apt to fufpect that fo curious an Engine was produc'd by any cafual concurrence of the Parts it confifts of, and not rather by the skill of an intelligent and ingenious Contriver; or that the Wheels, and other parts, were of this or that Size, or this or that determinate Shape, for any other reafon, then becaufe it pleas'd the Artificer to make them fo; though the reafon that mov'd the Artificer to employ fuch Figures and Quantities fooner than others, may well be fuppos'd to have been; that the nature of his Design made him think it very proper and commodious for its accomplifhment, if not better than any other fuited to the feveral Exigencies of it.

If an *Epicurean* fhould be told, That a Man, after having been for fome dayes really dead, became alive again, I think it will not be doubted, but that he would reject fuch a Relation as impoffible, and therefore too manifefly falfe to be believed by any man in his Wits: And yet, according to his principles, the Man, as well Soul as Body, confifted onely of divers Particles of the Universal Matter, by various Motions brought together, and dispos'd after a certain manner: And confequently, he muft ground his perfuafion that tis impoffible to redintegrate the Engine once fpoil'd by death, upon this

That

That as Chance cannot with the least probability be presum'd to have produc'd such a strange Effect; so according to him, there can be no cause assign'd, knowing and powerful enough, to rally and bring together again the disbanded and scattered parcels of Matter (or substitute other equivalent ones) that together with the remaining Carcase compos'd the dead Man, so to reunite them to the rest; and lastly so to place and put into Motion both the one and the other, as were requisite to make a living Man once more result from them. I know that this Example reaches not all the Circumstances of the Controversie we have been debating; but yet, if I mistake not, it will serve the turn for which I propose it. For, not now to insist upon this inference from it. That a considering Man may confidently reject a thing that is not absolutely impossible, provided it be highly incredible; nor to insist on this, I say, the thing I aim at in the Mention of it, is onely to shew, That such things may possibly be effected by Matter and Motion, as no wise Man will believe to have been produc'd by a bare Agitation of the Particles of Matter, not guided by the superintendency of a Powerful and Knowing Director.

Now that the Atoms, or Particles of Matter, of which the World consists, made no agreement with each other to convene and settle in the manner requisite to constitute the Universe, *Lucretius* does not so properly confesse, as affirm, in that fore-cited passage, where he judiciously tels us, That

-Certè neq; consiliis Primordiarerum
Ordine se quaq; atq; sagaci mente locarunt.
Nec quos quaq; darent Motus pepigère profecto,

And the thing it self is manifest enough, from the Nature of Atoms confessedly inanimate and devoid of Understanding,

So that although we should grant, *Pyrophilus*, the possible
Emers

Emergency of the innumerable Effects we admire in the World, from the various Properties and Coalitions of Atoms, yet still you see the formerly mention'd difficulty (touching the Resulting of All things from Matter left to it self) would recur; and it would as well be incredible that an innumerable multitude of insensible Particles, as that a lesser number of bigger Parcels of Matter, should either conspire to constitute, or fortuitously jumble themselves into so admirable and harmonious a Fabrick as the Universe, or as the Body of Man; and consequently it is not credible that they should constitute either, unlesse as their Motions were (at least, in order to their seminal Contextures and primary Coalitions) regulated and guided by an intelligent Contriver and Orderer of things. And I should so little think it a Disparagement to have but so much said of any *Hypothesis* of mine, that I suppose I may affirm it, without offending either the most sober, or the generality of the Atomical Philosophers. to whom, and to their Doctrine, my Writings will manifest to be no otherwise affected than I ought.



ESSAY





ESSAY V.

Wherein the discourse interrupted by the late Digression, is resumed and concluded.

IT remains now; *Pyroph*: that we at length return into the way from whence the foregoing Digression has, I fear, too long diverted us, and that to prosecute and finish our Discourse we take it up where we left it and were tempted to digress, namely, at the end of the III *Essay*; betwixt which, and the beginning of this V, all that has been interpos'd may be look'd upon but as a long Parenthesis.

In the Third place then I consider, That whether or no it be true which our Antagonists suggest, that there are some things in Nature which tempt Philosophers more than they doe the Vulgar, to doubt or deny a God; yet certainly there are divers things in Nature that do much conduce to the evincing of a Deity, which Naturalists either alone discern, or at least discern them better then other Men: For besides the abstruse Properties of particular Bodies, not discover'd by any but those that make particular Enquiries into those Bodies, there are many things in Nature, which to a superficial Observer seem to have no relation to one another; whereas to a knowing Naturalist, that is able to discern their secret Correspondencies and Alliances, these things which seem to be altogether Irrelative each to other, appear so Proportionate and so Harmonious both betwixt themselves, and in reference to the Universe they are parts of, that they represent to him a very differing and incomparably better Prospect then to another

That there are some things in Nature which conduce much to the evincing of a Deity which are only well known to Naturalists.

*Explain'd by the
comparison of the
uniting scatter'd
pieces of paint
into one face by a
cylindrical Look-
ing glass.*

Man: As he that looks upon a Picture made up of scatter'd and deform'd peices, beholding them united into one Face, by a Cyndrical Looking-glass aptly plac'd, discerns the skill of the Artift that drew it, better then he that looks onely on the fingle parts of that Picture, or upon the whole Picture, without the uniting Cylinder. Which brings into my minde, That whereas in the Sacred Story of the Creation, when mention is made of Gods having consider'd the Works of each of the first fix Days, at the end of it, it is said of the Work of every Day, *That God saw that it was good* (except of the second Day, because the separation of the Waters was but Imperfectly made on that day, and compleated in the next, on which it is therefore twice said, *That God saw that it was Good*) whereas, I say, when God look'd upon his Works in particular, it is onely said, *That he saw that they were good*; when He is introduc'd at the close of the Creation, as looking upon, and surveying his Creatures in their Harmony, and entire System, it is emphatically said, *That he saw every thing that he had made, and behold it was very good*. And if *Aristotle* be indeed the Author of the Book *De Mundo ad Alexandrum*, which passes for his, and is said to have been Written by him towards the end of his Life, it would not be unworthy our Observation to take notice, how he that in his other Writings is wont to talk of Gods Interest in the Creatures darkly, and hesitantly enough, is wrought upon by the Contemplation of the Universe, as it is an orderly Aggregate or System of the Works of Nature, to make Expressions of the Divine Architect, which are not unworthy of *Aristotle*, though being meerly humane they cannot be worthy of God. Amongst many I shall single out some; and I hope, *Pyrophilus*, you will excuse me, if in this *Essay*, and some of the precedent ones, I do contrary to my custom, employ pretty store of Passages taken out of other Authors. For first, the nature of my Design makes it requisite for me to shew what Opinion the Hea-then Philosophers had of the Study of Physiology, and what Power

*The Testimony of
the Author of the
book De Mundo
ascribed to Ari-
stotle introduced*

Power their Contemplation of Nature had to engage them to Acts of Religion. And next, since divers of the same Passages wherein they had set down their Opinions, contain'd also the Grounds and Reasons of them, whereby they have anticipated much of what we should say upon the same subjects, I was unwilling to deprive you of their pertinent Ratiocinations, or rob them of the Glory of what they had well Written.

And this necessary Appology premis'd, let us proceed to consider his passages; and first, *Restat* (sayes he) *ut summatim de Causa differamus, quæ cunctarum ipsa rerum vim habet tutricem*

Arist de Mundo, Cap. 6.

& continentem, quemadmodum cætera perstrinximus: Flagitii enim instar esset, cum de mundo dicere instituerim, tractatu si minus exquisito fortasse, at certè qui sat esse possit ad formulam doctrinæ crassiorem, intactam præcipuam mundi partem principemq; præterire.

And a little after, *Etenim* (sayes he) *cunctarum quæ rerum natura complectitur, cum servator est Deus, tum vero quæcunque in hoc mundo quoquomodo perficiuntur eorum omnium idem est Genitor: Non sic tamen ipse ut opificis in morem, animalisq; lassitudinem sentientis labore affici possit, ut qui ea facultate utatur, quæ nulli cedat difficultati, cujus ipse vi facultatis omnia in potestate continet, nec minus etiam quæ longius ab ipso videntur esse summotæ:*

Ibidem.

To which purpose he elsewhere sayes, *Augustius decentiusq; existimandum est, Deum summo in loco ita esse collocatum: Numinis ut tamen ejus vis per univèrsam mundum pertingens, tum Solem, Lunamq; moveat, tum Cælum omne circumagat, simulq; causam præbeat eorum quæ in Terra sunt salutis atq; incolumitatis:*

Eodem Cap.

And in the same Book he adds, *Ut vero summatim loquamur quod in navì Gubernator est, quod in Curru agitator, quod in Choro præcentor, quod deniq; lex in Civitate, & dux in exercitu, hoc Deus est in mûdo. Nisi si hætenus interest, qd labor, & motus multiplex illos exercet & cura angunt varia cum huic illaborata succedunt omnia, omnis molestiæ expertia.*

Eodem Cap.

And certainly he that is a stranger to Anatomy, shall never be able to discern in the corculation of the blood, the motion of the Chyle, and the contrivance of all the parts of a humane Body, those

Of the admirable
contrivance of
the make of the
Musculus Mar-
supialis.

Proofs, as well as Effects, of an Omniscient *Διαιτητής*, or Artist, which a curious Anatomist will discover in that elaborate and matchlesse Engine: as I remember, I had occasion not long since to take notice of in the shape of that strange Muscle (the *obturator internus*) which some call from its Figure *Mar supialis*, serving to the motion of the Thigh. For this Muscle seems so made, as if Nature had design'd in it, to manifest, That she is skill'd in the Machanicks, not onely as a Mathematician that understands the powers of Distance, Weight, Proportion, Motion and Figure; but as an Artificer, or Handy-crafts man, who knows by dextrous Contrivances to furnish the more endanger'd parts of his Worke, with what is more usefull to make it lasting: There being (to omit other Observables, belonging to that Muscle) a deep notch made in the *Coxendix*, to shorten the way betwixt the two extremities of the Muscle, and make it bear upon the Bone with a blunter Angle. And because the *Tendon* is long, lest, notwithstanding the former provision, it should be apt to fret out upon the edge of the Bone, Nature has provided for it a Musculous piece of Flesh, wherein it is as it were sheath'd, that so it might not immediately bear, and grates upon the Bone; just as our Artificers use to sow Cases of Leather upon those parts of silken Strings, which being to grate upon harder Bodies, were otherwise endangered to be fretted out by Attrition.

And of the parts
of the Hand.

And a like skilfulnesse of Nature in the Mechanical Contrivance of the Parts, is more Obviously discernable in the Structure of that admirable Engine, by which such variety of other Engines are made, the Hand: where (not to mention the *Ligamentum latum*, or Wrist-band, that keeps the *Tendons* that move under it from inconveniently starting up upon the Contraction of the respective Muscles) the wonderfull perforations that are made through the *Tendons* of the *Musculi perforati* by those of the *Musculi perforantes*, for the more commodious motion of the Joynts of the Fingers, may conspicuously manifest the Mechanical Dexterity of Nature; as it may her Husbanding

banding (if I may so speake) of her Work, That in a *Fetus*, The contrivance
 whil'ft it lies in the Womb, because the Lungs are not to be for the circula-
 display'd as afterwards, and so the Blood needs not circulate tion of the blood
 thorow Them from the right Ventricle of the Heart, into the in a Fœtus be-
 left, for the use of Respiration, as it must in grown Animals, fore the use of
 she contrives a nearer way; and by certain short Pipes, pecu- Respiration.)
 liar to such young Creatures, she more commodiously per-
 forms in them the Circulation of the Blood, proportion'd to
 their present condition; and afterwards, when the Animal is
 brought out of the Womb into the open Air, and put upon
 the constant exercise of his Lungs, these temporary Conduit-
 pipes little by little vanish. So careful is Nature not to do
 things in vain.

And therefore I do not much wonder, that *Galen*, though *Galen's speech*
 I remember he somewhere (unprovokedly and causelessly e- that his books
 nongh) derides *Moses*, and seems not over-much inclin'd De usu partium
 to make Religious acknowledgements; yet when he comes were as Hymn's
 to consider particularly the exquisite Structure of a humane to the Creator.
 Body should break forth into very elevated, and even pathetical
 Celebrations of God, and tell us, That in his Books, *De* Galenus lib. 3. on
usu Partium, he compos'd Hymns to the Creators praise. And De usu partium
 certainly he that shall see a skilful Anatomist dextrously The fabrique of
 dissect that admirable part of Man, the Eye, and shall consider the eye consid-
 red.
 the curious Contrivance of the several Coats, Humors; and
 other Parts it consists of, with all their adaptations and uses,
 would be easily perswaded, That a good Anatomist has much
 stronger Invitations to believe, and admire an Omniscient Au-
 thor of Nature, then he that never saw a Dissection, especi-
 ally if he should see how all of these concur to make up one
 Optical Instrument to convey the Species of the visible ob-
 ject to the Optick Nerve, and so to the Brui, as I have with
 pleasure consider'd it, in the recent Eye of a Cat (for with
 keeping, it will grow flaccid) cut cleanly off, where the Op-
 tick Nerve enters the *Scleroticus*, and is going to expand it self
 into the *Retina*, for holding this Eye at a convenient distance
 N 3 betwixt.

Some Experi-
mentall Obser-
vations of the
Eye, and the
use of its parts
in order to Vi-
sion.

The way to pre-
pare the Eyes of
Animals for the
better making
Observations on
them.

betwixt yours and a Candle, you may see the Image of a Flame lively exprest upon that part of the back side of the Eye at which the Optick Nerve enters the above-mention'd *Sclerotis*: something of this kind we have also shewn our Friends with eyes of dead Men, carefully sever'd from their heads; and with the (dexterously taken out) ChrySTALLINE humor of a Humane Eye, we have often read, as with a *Lens* or Magnifying glasse. And to assist you in so pleasing a speculation, as that of the Eye; wee shall adde, That by reason Ox Eyes are much larger, and more easier to be had then Humane ones, we are wont to make much use of them, and to discern some things better in their Coats, we immerse them for a little while in boyling Water, and to be able to consider the form and bigness of the Vitreous and ChrySTALLINE humors, better then the fluidity of the one, and the softnesse of the other are wont to allow Anatomists to do; we have sometimes by a way hereafter to be set downe, speedily frozen Eyes, and thereby have turn'd the Vitreous humor into very numerous and Diaphanous Films (as it were of Ice, and the ChrySTALLINE into a firm substance,) but (which perhaps you will wonder at) not Transparent. An Eye thus frozen, may be cut along that which Optical Writers call the Optical Axis, and then it affords an instructive Prospect, which we have not been able to obtain any other way. But because, notwithstanding this Expedient in the Eyes of Men, and the generality of Terrestrial Animals, the Opacousnesse of the *Sclerotis* hinders the Pictures that outward Objects (unlesse they be lucid ones) make within the Eye to be clearly discern'd. We think our selves oblig'd to that excellent Mathematician of your Acquaintance, *Pyrophilus*, who, upon some Discourse we had with him concerning this Subject, lately advi'd us to make use of the Eyes of white Rabbits (for if those Animals be of another colour, he sayes, their Eyes will not prove so fit for our purpose) For having held some of these Eyes at a convenient distance betwixt my Eyes and the Window, I found them to be so transparent, That the

rayes

rayes proceeding from the Pains of Glass, Iron Bars, &c. of the Window, passing through the ChrySTALLINE humor and in their passage refracted, did on the *Retina* exhibit in an inverted Posture, according to the Optical Laws, the contracted, but lively Pictures of those external Objects; and those Pictures, by reason of the transparency of the *Sclerotica*, became visible through it to my attentive Eyes: As in a darken'd Room the shadows of Objects without it; projected on a fine sheet of Paper, may, by reason of the thinness of Paper, be seen thorow it by those that stand behind it. By Candle-light we could see little in the bottom of these Eyes but lucid Objects, such as the flame of the Candle, which appear'd tremulous, though inverted; but by Day-light we could manifestly discern in them both the motions of very neighbouring Objects, and the more vivid of their colours.

And really, *Pyrophilus*, it seems to me not only highly dishonourable for a Reasonable Soul to live in so Divinely built a Mansion, as the Body she resides in, altogether unacquainted with the exquisite Structure of it; but I am confident, it is a great obstacle to our rendring God the Praises due to him, for his having so excellently lodg'd us, that we are so ignorant of the curious Workmanship of the Mansions our Souls live in; for not onely the Psalmist, from the consideration of the Divine Art display'd by God, in the moulding and fashioning his Body in the Womb, takes a just occasion to celebrate his Maker, *I will praise thee (saies he) because I am fearfully and wonderfully made; marvellous are thy works, and that my Soul knoweth right well: My substance was not hid from thee, when I was made in secret, and curiously wrought (with as much curiosity as Tapstry or Embroidery, as the Hebrew Rukkamtî seems to import) In the lowest parts of the Earth thine eyes did see my substance, yet being imperfect; and in thy Book all my members were written, which in continuance were fashioned, when as yet there were none of them.* But even from Galen himself Anatomical Reflections have been able to extort Expressions

Some particulars wherein the Eyes of white Rabbits are better than others for observation.

That it is dishonourable for the soul to be unacquainted with the exquisite structure of the body being its own Mansion.

Psal. 139. v. 14. 15. 16.

Proved out of Instances in the Psalmist and Galen.

Galen de plac:
Hip. & Plat.
Libr. 7.

of Devotion: Cum igitur (sayes he) quod in omnibus recte sit omnes ad artem referunt, quod autem in uno, aut duobus non ad artem, sed fortunam; merito ex nostri structura corporis licet admirari summam artem, equitatem & vim naturæ, quæ nos construxit. Constat siquidem corpus nostrum ex ossibus pluribus quam ducentis, ad singula ossa vero pervenit nutrienda vena; sicut ad musculos: cum hæc etiam arteria & Nervus, partaq; admissi sunt, & omnino similia in dextra animantis sita, in qua in altera sunt; Os ossi, Musculus musculo, Vena venæ, Arteria arteria, ac Nervus nervo, idq; exceptis visceribus, atque nonnullis particulis quæ habere propriam descriptionem videntur. Duplices itaq; corporis nostri partes, omnino inter se sunt similes & magnitudine & conformatione, sicuti & consistentia quam voco juxta molliorem, duritiemque differentia. Quemadmodum igitur de Humanis effectibus iudicium faciamus, ex navis summa arte constructa cognoscentes peritiam artificis, ita etiam de Divinis facere convenit, corporisq; nostri Opificem admirari, quicumq; tandem is Deorum existat, etiamsi eum non videmus.

Perhaps it may be truly said yet further, That although in humane Bodies, many Wonders, as we have lately mention'd, have been discover'd to us by Anatomy, yet Anatomy it self has not discover'd to us all the Wonders to be met with in a humane Body, nor will detect them, till Anatomists be skill'd in some other things over and above that of dexterously dissecting: For it seems very probable, that the excellent contrivance of some parts will never be fully apprehended, without a competent knowledge of the Nature of those Juices that are to pass thorow them, and some of them receive their beginning or some alteration in them; And the Nature of these Juices will scarce be exactly known, without some skill in divers parts of Physiology, and especially in Chymistry. Besides the reason of the Origination, Shape, Bulk, Length, Progress, and Insertion of each particular Muscle, can hardly be well accounted for without some skill in the Principles of Mechanics, and in the nature and properties of Leavers, Pulleys,

leys, &c. Moreover, there is a certain Harmonious Proportion betwixt the parts of a humane Body, in reference both to the whole, and to one another, which is not wont to be heeded by Anatomists, but much taken notice of by Statuaries and Painters. For they reckon, that when a mans Arms are display'd, the distance betwixt his midle fingers is equal to the height of his Body; so they reckon sometimes seven, sometimes eight lengths of the head, to the length of the body; and four times the length of the Nose to that of the Head, as three times the same length to that of the Face. And divers such Observations we have met with among them, which we shall not now insist on, but rather tell you, That without some skill in Opticks, it will be hard for an Anatomist to shew the Wisdom of God in making the ChrySTALLINE humor of the Eyes of Men onely of a somewhat convex or lenticular form, rather than as those of Fishes of an almost perfectly Spherical one (as to the anterior part, which is obverted to the outward objects.) Nor do I remember that in Anatomy Schools I have heard any account give of this difference, which yet tends much to manifest the wisdom of the Author of Nature, who has so excellently suited the Eyes of Animals to the several parts of the Universe he design'd them to inhabit. For Men, and other Terrestrial Animals living in the Air, the beams of Light, reflected from visible objects, & falling over the *Cornea*, and the aqueous humor, do necessarily suffer a Refraction there, as coming from the Air, which is a thinner *medium*, into a thicker, & so there needs the less of farther Refraction to be made by the ChrySTALLINE humor, & consequently its Figure needs to be but moderately convex; whereas fishes living constantly in the water, the *medium*, through which they see things, is almost of a like thicknes with the *Cornea* & Aqueous humor, so that there being litle or no refraction made in their Eyes but by the chrySTALLINE it self, it was necessary that that should be exceedingly convex, that it might make a very great Refraction, & thereby unite the beams nearer at hand; which if the CRYSTALLIN were less

why the anterior
part of Fishes
eyes ought to be
more Spherical
than those of
Men.

convex, would tend to a point of Concours beyond the *Real-
na*, and consequently paint on it but a languid and confus'd
Picture of the Object they should represent.

That God made
Man not after
the worlds image,
but his Own.

Lib. 3. De usu
Part.

That the Image
of God on us
should engage us
to esteem our
selves as belong-
ing to God.

As for *Paracelsus*, certainly he is injurious to Man, if (as
some eminent Chymist expound him) he calls Man a Micro-
cosm, because his Body is really made up of all the several
kinds of Creatures the Macrocosm or greater World consists
of, and so is but a Model or Epitome of the Universe: For (to
omit that the Antients (as *Galen* informs us) gave the Title of
Microcosms to Animals in general) tis the Glory and Prero-
gative of Man, that God was pleas'd to make him not after the
Worlds Image, but his Own. On which occasion give me
leave to tell You, That however, the consideration of the dig-
nity conferr'd on us in the Image of God, (in whatever that
Image be resolv'd to consist) should, me thinks, be some en-
gagement to us to look upon our selves as belonging unto
God; As our Saviour, from the Image of *Cesar* stampt upon
a Coyn, pronounc'd it fit to render unto *Cesar* the things of *Ca-
sar*, and to God those of God.

Arguments from
Authority, and the
Experience of all
Ages, that the
contemplation of
the World has
addis'd Man
to the Reverence
of God.

In the fourth place, I consider that the universal experience
of all Ages manifests, That the contemplation of the World
has been much more prevalent to make those that have addic-
ed themselves to it, Believers, than Deniers of a Deity. For
tis very apparent that the old Philosophers, for the most part,
acknowledg'd a God, and as evident it is by their want of Re-
velation, by many passages in their Writings, and by divers
other things not now to be insisted on, That the consideration
of the works of Nature, was the chief thing that induc'd them
to acknowledg a Divine Author of them. This Truth I could
easily make out, were I at leisure to transcribe Testimonies,
which, because I am not, I shall content my self to mention to
you one, which may well serve for many, it being a Confession
made by *Aristotle*, or whatever other Learned Philosopher it
was, who writ the Book *De Mundo*, That Gods being the Ar-
chitect and Upholder of the World, was the general belief of
the

the Ages that preceded his. *Vetus* (saies he) *sermo est à majoribus proditus, inter omnes homines, universa tum ex Deo tum per Deum constituta fuisse, atq; coagmentata, nullamq; naturam satis instructam ad salutem esse posse, quæ citra Dei præsidium, suæ ipsa demum tutela permissa sit.* And as for both the Opinion of that eminent Author himself, and the Grounds of it, he speaks of God and the Creation almost in the terms of S. Paul: *Proinde* (saies he) *hæc etiã de Deo sentienda nobis sunt, illo quidem, si vim spectes, Valentissimo, si decorem, Formosissimo, si vitam, Immortalis, deniq; si virtutem Præstantissimo. Quæ propter cum sit inconspicibilis natura omni interituræ, ipsis nihilominus ipse cernitur ab operibus, atq; ea quidem quæ aëre quoquo modo affecto, quæ in terra, quæ in aqua, ea certè Dei opera esse merito dixerimus: Dei inquam opera, cum imperio summo Mundum, ac pro potestate obitæntis, Ex quo Deo ut inquit Empedocles Physicus.*

Libro de Mundo, cap. 6.

Alibi eodem c.

*Omnia quotquot erunt, quot sunt præsentia, quotq;
Orta fuere antehac stirpes, hominesq; feraq;
Inde etiam volucres, piscesq; humoris Alumni.*

And those few Philosophers (if ever there have been any at all) that have been really Atheists, are no ways considerable for their number, in respect of those that have asserted a Deity; & their Paradoxes have been lookt upon as so Irrational, that as soon as they have been propos'd, they have been disdainfully rejected and condemn'd by all the rest of Man-kind, who have look'd upon the Patrons of them as Monsters rather than Philosophers. And if there be, at this day, any Nations (as Navigators inform us there are in *Brasil*, and some other parts of the *Indies*) that worship no God, they consist not of Naturalists, but Bruit, and Irrational Barbarians, who may be suppos'd rather to ignore the Being of God, than deny it; and who at least are little lesse strangers to the Mysteries of Nature, than to the Author of it, And if it be a Truth that there

That those people who worship no God, are not Naturalists but Barbarians, and that their Atheism doth continue for want of the contemplation of the World.

are really such Atheistical People, it may serve to recommend to us the Study of Physiology, by shewing us, That without the help of any such innate belief, or perswasion of a God, as is suppos'd connatural to Man, Reason exercis'd upon the Objects the Creation presents us with, is sufficient to convince Philosophers of a Deity; and indeed such a care has God taken, to make his Being conspicuous in his Creatures, that they all seem loudly and unanimously to speak to their attentive Considerers, in the Psalmists Language, *Know ye that the Lord he is God; tis he that hath made us, and not we our selves.* And as it is said, *That the Stars in their courses fought against Sifera,* so it may be truly said, That not onely the Stars, but all the rest of the Creatures do in their courses fight against the Atheists, by supplying an unprejudic'd Considerer of them with Weapons fit to overthrow his impious Error. To which purpose I remember *Aristotle*, in his Book *De Mundo*, makes use of a pretty Simile, to declare the conspicuousness of the Creator in his Creatures: *Fama est (saies he) Phidiam illum statuarium, quum Minervam illam que est in Arce, coagmentaret, in medio ejus scuto faciem suam expressisse, oculoq; fallenti artificio ita devinxisse simulachro, eximere ut inde ipsam si quis cuperet, minime posset, aliter quidem certe, quam ut ipsum solveret simulachrum, opusq; ejusmodi compactile confunderet: Hanc eandem rationem Deus habet in Mundo, utpote qui universorum coagmentationem coherentem cohibeat & coarctet, incolumitatemq; Universitatis conservet, nisi quatenus non medio ille loco in Terra scilicet, ubi Turbida Regio est, sed in excelsa situs est, purus ipse in puro loco.*

But to declare how Atheists may be reduc'd either to confess a first Cause, or to offer violence to their own Faculties, by denying things as certain as those, which tis apparent that (in other cases) themselves firmly assent to, would require a Discourse too large to be proper to be prosecuted here, and therefore if I have not, in another Treatise, an opportunity of insisting on that Subject, I must content my self to refer you for

Psalm. 100. 3.

Judg. 5. 20.

Cap. 6.

A comparison of the image of God on the Creature to that of Phidias or Minervas shield.

for further satisfaction on it, to the Writers of Natural Theology:

Nor does Physiologie barely conduce to make men believe the existence of a Deity, but admire and celebrate the Perfections of it: And the noblest Worship from that greater part of the World, to which God did not vouchsafe any explicate and particular Revelation of his Will, hath been paid Him, by those whom the beauty of this goodly Temple of the Universe transported with a rational Wonder at the Wisdom, Power, and Goodnesse of the Divine Architect. And this kind of Devotion being commonly proportionate to the discoveries of Nature that begot it, it needs not seem strange, that divers of the best Philosophers amongst the Heathens, should be the greatest Celebrators of God. And twas therefore perhaps not without cause that the *Indian* Gymnosophists the *Persian Magi*, the *Egyptian* Sacrificers, and the old *Gauls Druides*, were to their People both Philosophers and Priests; and that in divers Civiliz'd Nations, Philosophy and Priesthood were so ally'd, that those whose Profession should give them most interest in the definition of Man, made a more strict profession of celebrating and praising God. I might easily, with diverse Instances, manifest how great a Veneration the Study of the Creatures has given Philosophers, for those Attributes of God that are stamp'd upon them, and conspicuous in them: but my willingness to hasten to the more Experimental part of what I have to say concerning the usefulness of Physiologie, makes me content my self to present you with a couple, or a leath of Authorities, for proof of what has been alledg'd; the first shall be of *Galen*, in his third Book *De usu Partium*, where treating of the Skin that invests the sole of the Foot, *Cutem ipsam* (sayes he) *non laxam, aut subtilem, aut mollem, sed constrictam, & mediocriter duram, sensilemque, ut non facile pateretur, subdidit pedi sapientissimus Conditor noster: Cui commentarios hos, ceu hymnos quosdam compono, & in eo pietatem esse existimans, non si Taurorum* *εὐαν'μους* *et plurimas quisi-*
piam

The noblest worship that has been paid God from such who have not had particular Revelation of

his will, has arose from the Speculation of Gods wisdom, Power, and goodness in the fabric of the Creatures.

The Testimonies of Galen, Hermes, Paracelsus L. Bacon.

piani sacrificarit, & casias alias, sexcenta unguenta suffumigaverit. Sed si noverim ipse primus deinde exposuerim aliis quam sit ipsius Sapiencia, qua Virtus, qua Providentia, qua Bonitas, Ignorantia quorum summa Impietas est, non si à Sacrificio abstinens. Quod enim cultu convenienti exornavit omnia, nullis bona inviderit id perfectissima Bonitatis specimen esse statuo. Invenisse autem quo pacto omnia adornarentur summa Sapiencia est, at effecisse omnia qua voluit Virutis est invicta. To which illustrious Passage he annexes much more, worthy of Galens pen, and your perusal.

To this let me adde, in the second place, that of *Hermes Trismegistus*, almost at the very beginning of his first Book, Englished by Dr. Everard: *He that shall Learn and Study the things that are, and how they are ordered and governed, and by whom, and for what cause, or to what end, will acknowledge thanks to the Work-man, as to a good Father, an excellent Nurse and a faithful Steward; and he that gives Thanks shall be Pious or Religious, and he that is Religious shall know both where the Truth is, and what it is; and learning that he will be yet more and more Religious.* To which I cannot but adde a resembling Passage of that great Hermetical Philosopher (as his Followers love to call him) *Paracelsus: Oppido (sayes he) admirabilia in suis Operibus, Deus est; à quorum contemplatione nec interdiu, nec noctu desistendum, sed jugiter illorum indagationi vacandum est, Hoc enim est ambulare in Vis Dei.* All which bears witness to, and may, in exchange, receive Authority from that remarkable passage of that Great and Solid Philosopher, Sir Francis Bacon, who scruples not somewhere to affirm, 'That a litle or superficial taste of Philosophy, may, perchance, incline the mind of a Man to Atheism, but a full Draught thereof brings the Mind back again to Religion. For in the entrance of Philosophy, when the Second Causes, which are next unto the Senses, do offer themselves to the Mind of Man, and the Mind it self cleaves unto them, and dwells there,

Paracel. de Mineral. Tract. 1.

Sir Francis Bacon Advanc: of Learning. l. 1.

there, a forgetfulneſſe of the Higheſt Cauſe may creep in: but when a Man paſſeth further, and beholds the Dependency, Continuation, and Confederacy of Cauſes, and the Works of Providence, then according to the Allegory of the Poets, he will eaſily believe that the higheſt Link of Natures Chain muſt needs be tyed to the foot of *Jupiters* Chair; or (to ſpeak our Chancellors thoughts more Scripturally) That Phyſiology, like *Jacob's* Viſion, diſcovers to us a *Ladder, whoſe Top reaches up to the Foot-ſtool of the Throne of God:* To which he deſervedly addes; *Let no Man, upon a weak conceit of Sobriety, or ill-applied Moderation, think or maintain that a Man can ſearch too far, or be too well ſtudied in the Book of Gods Word, or in the book of Gods Works, Divinity, or Philoſophy: But rather let Men awake themſelves, and cheerfully endeavour and purſue an endleſſe progreſſe or proſiciency in both; onely let them beware leſt they apply Knowledge to Swelling, not to Charity, to Oſtentation, not to Uſe. And again, That they do not unwiſely mingle and confound theſe diſtinct Learnings of Theology and Philoſophy, and their ſeveral Waters together.* Gen. 28.

In the fifth place, *Pyrophilus*, I conſider, that when the Divines we are anſwering ſuppoſe Phyſiology likely to render a Man an Atheiſt, they do it (as hath above been noted already) upon this Ground, That Natural Philoſophy may enable him to explicate both the regular *Phænomena*, and the aberrations of Nature, without having recourſe to a firſt Cauſe or God: But though this ſuppoſal were as great a Truth, as we have endeavoured to make it a Miſtake, yet I ſee not why a Studier of Phyſiology, though never ſo great a Proſicient in it, may not rationally be an utter Enemy to Atheiſm. For the Contemplation of the Creatures, is but one of the ways of coming to be convinc'd that there is a God; and therefore, though Religion were unable to make uſe of the Argument drawn from the works of Nature, to prove the exiſtence of a Deity, yet has ſhe other Arguments enough beſides, to keep any Conſiderate and

That Religion
has other Argu-
ments besides
those drawn from
the work of Na-
ture, enough to
keep any confi-
dering man from
Atheism.

Jam. 2. 19.

and Impartial Man from growing an Atheist. And here give me leave, for the sake of these Divines, to observe, That though the Devils be Spirits, not onely extremely knowing in the Properties of Things (by their hidden skill in Physiolygy, by which they teach Magicians, and their other Clients, to do divers of the strange things for which they are admired) but also unmeasurably proud, and willing to pervert their knowledge to the cherishing of Atheism, yet St. James informs us, *That they themselves believe there is a God, and tremble at him;* which argues, either that skill in Natural Philosophy does not necessarily lead to Atheism, or that there are other Arguments, besides those drawn from Science, sufficient to convince the most refractory of the existence of a Deity.

But not to insist on any thing of this nature, nor so much as to mention what proofs the consideration of our own Minds, and their in-bred Notions may afford us of a Deity, I shall content my self to mind You, That the several Patefactions which God has been pleas'd to make of himself, to Man especially, those made by seasonably accomplish'd Prophecies, and by Miracles, do not onely demonstrate the Being, but the Providence, and divers of the Attributes of God. And indeed, me thinks, the Divines we reason with may well allow these Patefactions to be capable of evincing the existence of a God, since they are sufficient, and, for ought I know, the best Arguments we have to convince a rational man of the truth of the Christian Religion. For the Miracles of Christ (especially his Resurrection) and those of his Disciples, by being Works altogether supernatural, overthrow Atheism; and being owned to be done in Gods name, and to authorize a Doctrine ascrib'd to his Inspiration, his Goodnesse and his Wisdom, permit us not to believe that he would suffer such numerous, great, and uncontronled Miracles, to be set as his Seals to a Lie, and delude men little less than inevitably into the belief of a Doctrine not true. And as for the Miracles themselves (especially that
of

of Christs Resurrection, so much, and so deservedly insisted on by *Peter* to the Jewes, and *Paul* to the Gentiles) the truth of them is so ascertain'd to us by many of the solemnest, and most authentick wayes of Attestation, whereby the certainty of Matters of Fact is capable of being satisfactorily made out, that 'tis hard to shew how these Testimonies can be deny'd, without denying some acknowledg'd Principle of Reason, or some other received Notion, which these Contradictors Opinions or Practice manifest them to look upon as a truth. And upon this account, so much might be said to evince the reasonableness of assenting to the Christian Religion, and to shew, that as much may be said for it, as need be said for any Religion, and much more then can be said for any other; that it need be no wonder, that, as Learned Men as ever the World admit'd, have not onely been many of them Embracers, but some of them Champions of it. But having more fully, in another Treatise, discours'd of this subject, I shall content my self to make this Inference from what has been alledg'd, that since the most Judicious Propugners of Christianity have held and found, that, upon the score of Gods miraculous Revelations of himself, rational Men might be brought to believe the abstruser Articles of the Christian Religion, those Revelations cannot but be sufficient to convince them of so fundamental and refulgent a Truth (which all the others suppose) as that of the existence of God.

In the sixth and last place, I will here adde (on this occasion) that an insight into Physiological Principles, may very much assist a Man to answer the Objections of Atheists, against the Being of a Deity, and the Exceptions they make to the Arguments brought to prove that there is one: For though it has long been the custome of such Men, to talk as if themselves, and those of their mind, were not alone the best, but almost the onely Naturalists; and to perplex others with pretending, that, whereas it is not conceivable how there can be a God,

all things are by the principles of the Atomical Philosophy; made clear and facil. Though this, I say, have long been us'd among the Opposers of a Deity, yet he that not regarding their confidence, shall attentively consider the very first Principles of things, may plainly enough discern, that of the Arguments wherewith Natural Philosophy has furnish'd Atheists, those that are indeed considerable, are far fewer then one would readily think; and that the difficulty of conceiving the Eternity, Self-existence, and some other Attributes of God (though that afford them their grand Objection) proceeds not so much from any absurdity belonging to the Notion of a Deity, as such; as from the difficulty which our dim humane Intellects finde to conceive the nature of those first Things (whatever we suppose them) which, to be the Causes of all others; must be themselves without cause: For he that shall attentively consider, what the Atomists themselves may be compell'd to allow concerning the Eternity of Matter, the origine of local Motion (which plainly belongs not to the Nature of Body) the infinity or Boundlessness of space, the Divisibleness or non-Divisibility of each Corporeal Substance into infinite Material Parts, may clearly perceive that the Atomist, by denying that there is a God, cannot free his Understanding from such puzzling Difficulties as he pretends to be the Reasons of his Denyal. For instead of one God he must confesse an infinite number of Atoms to be Eternal, Self-existent, Immortal, Self-moving, and must make suppositions, incumbred with Difficulties enough to him that has competently accustomed his Thoughts to leave Second Causes beneath them, and contemplate those Causes that have none. But I am unwilling to swell this Essay, by insisting on such Considerations as these, especially since you may finde them more aptly deduc'd in other Papers, some of which treat of the Truth of Christian Religion, and others are design'd for the Illustration of some things in this and

That the difficulty of conceiving the Eternity, self-existence, and other attributes of one God is lesse then to conceive infinite eternal self-existent and self-moving Atomes.

and the fore-going Essayes. For I must confess to you, *Pyrophilus*, that by reason of the sundry Avocations, I have been so diverted from proposing some of the Reasons I have employ'd to their best advantage, that I my self, at another time, could have both mention'd them with lesser disadvantage, and have added divers others: And therefore I have not onely had thoughts of enlarging upon some Passages of our past Discourse, but I long since made a Collection (though it be not now in my power) of Observations, and Experiments to elucidate a point in one of those Discourses, whereby may be enervated one of the three chief Physiological Reasonings, that I have met with among the Atheists.

Upon consideration of all the Premises, I confess, *Pyrophilus*, that I am inclined to think there may, perhaps, be more cause to apprehend, that the delightfulness of the Study of Physiology should too much confine your Thoughts and Jones to the Creatures, then that your Proficiency in it should bring you to dis-believe the Creator: For I have observ'd it to be a fault, incident enough to Ingenious Persons, to let their minds be so taken up, and, as it were, charm'd with that almost infinite variety of pleasing Objects, which Nature presents to their Contemplation, that they too much dis-relish other Pleasures and Employments, and are too apt to undervalue even those wherewith the improv'd Opportunities of serving God, or holding Communion with Him, are capable of Blessing the Pious Soul.

But, *Pyrophilus*, though comparatively to Fame, and Mistresses, and Baggs, and Bottles, and those other transient, unsatisfactory, (in a word) deluding Objects, on which the greatest part of mistaken Mortals, so fondly dote, the entertaining of our Noblest Faculties, with Objects suited to them, and proper both to gratifie our Curiosity, and to enrich our

understandings, with variety of acceptable and useful Notions, affords a satisfaction that very well deserves the choice and preference of a rational Creature: Yet certainly, *Pyrophilus*, as God is infinitely better than all the things that he has made, so the Knowledge of Him is much better than the knowledge of them; and he that has plac'd so much delightfulness in a Knowledge, wherein he allows his very Enemies to become very great Proficients, has sure reserv'd much Higher, and more contenting Pleasures to sweeten and endear those Disclosures of Himself, which He vouchsafes to none but those that love Him, and are lov'd by Him.

As God is infinitely better than all his Creatures so the knowledge of him is better than the knowledge of his Creatures.

And therefore, *Pyrophilus*, though I will allow you to expect from the Contemplation of Nature a greater satisfaction, then from any thing you need decline for it, yet I would not have you expect from it any such satisfaction as you may entirely acquiesce in, for nothing but the enjoyment of him that made the Soul for himself can satisfy it, the Creatures being as well incapable to afford us a compleat Felicity by our Intellectual Speculations of them, as by our sensual Fruitions of them; for though the knowledge of Nature be preferable by odds to those other Idols which we have mention'd, as inferior to it, yet we here attain that knowledge, but very imperfectly, and our acquisitions of it cost us so dear, and the Pleasures of them is so allay'd with the disquieting Curiosity they are wont to excite, that the wisest of Men, and greatest of Philosophers among the Antients, scruples not, upon his own experience, to call the addicting of ones heart to seek and search out by Wisdome, concerning all things that are done under the Heaven, a sore travel given by God to the sons of Men; to be exercis'd (or, as the Original hath it, to afflict themselves) therewith: And the same experienc'd Writer elsewhere tells us, That he that encreases knowledge, encreases sorrow. And 'twas perhaps for this reason that *Adam* was form'd out of Paradise, and afterwards by God brought into it, to intimate, That Felicity

The Imperfection and disquiet that there is in humane science.

Eccles. 1. 13.

Eccles. 1. 18.

Felicity is not a thing that Man can acquire for himself, but must receive as a free gift from the liberal Hand of God: And as the Children of the Prophets sought translated *Elias* with very great diligence, but with no successe, so do we as Fruitlessly as Industriously, seek after perfect Happinesse here, both they and we, missing of what we seek for the same reason; because we seek for that on Earth, which is not to be found but in Heaven: And this I forewarn you of, *Pyrophilus*, not at all to discourage you from the study of Physiology, but to keep you from meeting with that great Discouragement of finding in it much less of satisfaction then you expected, and overgreat expectation from it, being one of the disadvantageous Circumstances with which it is possible for any thing to be enjoyed.

^aKing. cap. 2.

But at length, *Pyrophilus*, though late, I begin to discern into how tedious a digression my zeal for Natural Philosophy, and for you, has mis-led me, and how it has drawn from my Pen some Passages, which may seem to relish more of the Preacher, then the Naturalist; yet I might alledge divers things to justifie, or, at least, extenuate what I have done: As first, That if in making this Excursion I have err'd, I have not done so without the Authority of great Examples; for not only *Seneca* doth frequently both season his Natural Speculations with Moral Documents and Reflections, and owns, that he purposely does so, where he sayes, *Omnibus rebus, omnibusq; sermonibus aliquid salutare miscendum est, cum imus per Occulta Natura*, &c. but even *Pliny* (as far as he was from being guilty of over much Devotion) does from divers Passages in his Natural History, allow himself to take occasion to inveigh against the Luxury, Excesses, and other Epidemical Vices of his time. And I might next represent, that perhaps the endeavoring to manifest, that the knowledge of the Creatures should, and how it may be referr'd to the Creators Glory, is not altogether impertinent to the design I have of promoting

Seneca Nat. Quest. lib. 2. cap. 59.

How the Favour
of God conduces
to promote Mens
proficiency in
the study of Na-
ture.

Jam. 1. 17.

Isa. 28. 25, 26.

Gen. 31.

Physiology, for it seems consonant both to Gods Goodnesse, and that repeated Axiome in the Gospel, which tells us, *That he that improves his Talents to good uses, shall be intrusted with more*, That the imploying the little Knowledge I have in the service of Him I owe it to, may invite Him to increase that little, and make it lesse despicable. And perhaps it is not the least cause of our ignorance, in Natural Philosophy it self, that when we study the Great Book of Nature, call'd *The Universe*, we consult, peradventure, almost all other Expeditors to understand its Mysteries, without making any address for instruction to the Author, who yet is justly stil'd in the Scripture, *That Father of Lights* (in the plural Number) *from whom descends every good and every perfect gift*, not only those supernatural Graces, that relate to another World, but those intellectual Endowments, that qualifie Men for the prosperous Contemplation of this: And therefore in the Evangelical Prophet, he is said, to instruct even the Plough-man, and teach him the skill and understanding he displayes in his own Profession. And though I dare not affirm, with some of the *Helmontians* and *Paracelsians*, that God discloses to Men the Great Mystery of Chymistry by Good Angels, or by Nocturnal Visions, as he once taught *Jacob*, to make Lambs and Kids come into the World speckled, and ring-streaked, yet perswaded I am, that the favor of God does (much more then most Men are aware of) vouchsafe to promote some Mens Proficiency in the study of Nature, partly by protecting their attempts from those unlucky Accidents which often make Ingenuous and Industrious endeavors miscarry: and partly by making them dear and acceptable to the Possessors of Secrets, by whose Friendly Communication they may often learn that in a few Moments, which cost the Imparters many a Years toyl and study; and partly too, or rather principally, by directing them to those happy and pregnant Hints, which an ordinary skill and industry may so improve as to do such things, and make

make such discoveries by virtue of them, as both others, and the person himself, whose knowledge is thus encreased, would scarce have imagin'd to be possible: And in effect, the chiefest of the Secrets that have been communicated to me, the Owners have acknowledg'd to me to have been attain'd, rather, as they were pleas'd to speak, by accidental Hints, then accurate Enquiries: confessions of this nature I have divers times met with in the Writings of the more Ingenious of the Chymists, and of other Naturalists, and by one of these accidental Hints, of late, the acute and lucky *Pecquet* was directed to find the newly discovered *Lactea Thoracica*, as before him *Asellius* found without seeking, as himself confesseth, the *Lactea Mesenterica*, and by an accident too (as himself hath told me) did our industrious Anatomist, Dr *Folius*, first light upon those yet more freshly detected Vessels, which afterwards the Ingenious *Bartholinus*, without being inform'd of them, or seeking for them, hath met with, and acquainted the World with, under the name of *Vasa Lymphatica*; and the two great Inventions of the latter Ages, Gunpowder, and the Loadstones respect unto the Poles, are suppos'd to be due rather to chance, then any extraordinary skill in Philosophical Principles (which indeed would scarce have made any Man dream of such extravagant Properties, as those of Magnetick Bodies (As if God design'd to keep Philosophers humble, and (though he allow regular Industry, sufficient encouragement, yet) to remain Himself dispenser of the chief Mysteries of Nature.

To what hath been represented, *Pyrophilus*, I might adde much more to excuse my Excursions, if I were not content to be beholden to you for a Pardon, and to invite you to grant it me, I shall promise you to be very careful not to repeat the like offence, and whereas most Chymical Writers take occasion

The reason of the
Authors so long
discourse on this
Subject.

tion from almost every Discovery or Process they acquaint us with, to digress and wander into tedious, and too often dull and impertinent Theological Reflections or Sermons. I have troubled you with almost all that I have to say (to you) of Theological at once, and I have endeavored to sprinkle it as far as the subject would allow me, with some passages Experimental. And indeed I should not at all have engag'd my self into so long a Discourse of the not onely Innocency, but Usefulnesses of the knowledg of Nature, in reference to Religion, but that I could not acquiesse in what I had met with on that subject in any of the Writers I have perus'd, Divines being commonly too unacquainted with Nature, to be able to manage it Physiologically enough, and Naturalists commonly esteeming it no part of their work to treat of it at all. And therefore I scruple not to confels freely to you, *Pyrophilus*, that, as I shall think my self richly rewarded for all the ensuing Essays, if the past Discourse but prove so happy as to bring you to value, and to make the Religious use of the Creatures recommended to you in it: So I had rather any of my Papers should be pass'd by unperus'd, then those parts of these Essays that treat of that use. And indeed 'tis none of the least of Satisfaction, I hope, to derive from my Physical Composures, that by premising before them the now almost finish'd Discourse, I have done my hearty endeavor to manifest and recommend the true use of all the Discoveries of Nature, which either my Enquiries, or your own, may afford you. And indeed for my part, *Pyrophilus*, I esteem the Doctrine I have been pleading for of that importance, that I am perswaded, That he that could bring Philosophical Devotion into the request it Merits, should contribute as much to the solemnizing of Gods Praises, as the Benefactor of Choristers and Founders of Chauntries, and not much lesse then *Dauids* so celebrated

brated

brated designation and settlement of that Religious Levitical Musick, instituted for the solemn Celebration of God.

For the sensible Representations of Gods Attributes to be met with in the Creatures, occurring almost every where to our observation, would very assiduously sollicit us to admire Him, did we but arightly discern Him in them: And the Impressions made on the Mind by these Representations, proceeding not from a bare (and perhaps languid) whether Beliefe or Notion of the Perfections express'd in them, but from an actual and operative intuition of them, would excite an admiration (with the Devotion springing thence) by so much the more intense, by how much (it would be) more rational. And sure, *Pyrophilus*, so much admirable Workmanship as God hath display'd in the Universe, was never meant for Eyes that wilfully close themselves, and affront it with the not judging it worthy the Speculating. Beasts inhabit and enjoy the World; Man, if he will do more, must study and (if I may so speak) Spiritualize it. 'Tis the first act of Religion, and equally obliging in all Religions: 'Tis the Duty of Man, as Man; and the Homage we pay for the Priviledg of Reason: which was given us, not onely to refer our selves, but the other Creatures, that want it, to the Creators Glory. Which makes me sometimes angry with them who so busie themselves in the Duties and Employments of their second and superinduc'd Relations, that they will never find the leisure to discharge that Primitive and Natural Obligation, who are more concern'd as Citizens of any place, than of the World; and both worship God so barely as Catholick or Protestants, Anabaptists or Socinians, and live so wholly as Lords or Councilors, *Londoners* or *Parisians*, that they will never find the leisure, or consider not that it concerns them to worship and live as Men. And the neglect of this Philosophical Worship of

Beasts inhabit and enjoy the World, tis mans duty to Spiritualize it.

That it being the prime duty of Man to give God the honour of his Creatures, it is to be preferred before secondary Duties.

God, for which we are pleading, seems to be culpable in men proportionably to their being qualified, and comply with that invitation of the Psalmist, to *sing Praises to God with Understanding*, or (the Expression in the Original being somewhat ambiguous) *to sing to him a learned Canticle*, as he elsewhere speaks, *to praise him according to his excellent Greatness*. For Knowledge being a Gift of God, intrusted to us to glorifie the Giver with it, the Greatness of it must aggravate the neglect of employing it gratefully; and the sublimest Knowledge here attainable will not destroy, but only heighten and enoble our admiration, and will prove the Incense or more Spiritual and acceptable part of that Sacrifice of Praise (for those Reflections which their Nature makes onely acts of Reason, their End may make acts of Piety) wherein the Intelligent Admirer offers the whole World in Eucharists to its Maker. For Admiration (I do not say Astonishment or surprize) being an acknowledgment of the Objects transcending our Knowledge, the learned the transcendent Faculty is, the greater is the admired Objects transcendancy acknowledg'd. And certainly, God's Wisdom is much less glorified by the vulgar astonishment of an unlettered Starer (whose Ignorance may be as well suspected for his Wonder, as the Excellency of the Object) than from their Learned Hymns, whose industrious Curiosity hath brought their Understandings to a prostrate Veneration of what their Reason, not Ignorance, hath taught them not to be perfectly comprehensible by them.

And as such persons have such piercing Eyes, that where a transient or unlearned glance scarce observes any thing, they can discern an adorable Wisdom, being able (as I may so speak) to read the Stenography of Gods omniscient hands; so their skilful Fingers know how to choose, and how to touch those Strings that may sound sweetest to the Praise of their
Maker

Psal. 47. 7.

Psal. 150. 2.

Maker. And on the open'd Body of the same Animal, a skilful Anatomist will make reflections, as much more to the honor of its Creator, than an ordinary Butcher can; as the Musick made on a Lute, by a rare Lutanist, will be preferable to the noise made on the same Instrument by a Stranger unto Melody. And give me leave to tell you, *Pyrophilus*, that such a reasonable Worship (*λογική λατρεία*) of God (to use *St. Paul's* Expression, though in another sense) is perhaps a much nobler way of adoring him, than those that are not qualified to practise it, are aware of, and is not improper even for Christians to exercise. For, *Pyrophilus*, it would be considered, That as God hath not by becoming (as the Scripture more than once styles him) our Saviour, laid by his first Relation to us as our Creator (whence *St. Peter* exhorts, even the suffering Christians of his time, to commit their Souls to God under the notion of a Faithful Creator) so neither hath he given up his right to those Intelligent Adorations from us, which become us upon the account of being his rational Creatures: neither are such performances made less acceptable to him by the filial relation, into which Christ hath brought us to him; that Glorious relation as well endearing to him our Services, as our Persons.

That the different greatness in the knowledge make a like difference in the Honor given to the Creator-

Rom. 12. 1.

1 Tim. 1. 1.
Tit. 2. 10.

1 Pet. 4. 19.

God by becoming our Saviour, has not laid aside the Relation of a Creator.

And let me adde, *Pyrophilus*, that not onely *Galen* (as we have seen already) tells us, That the discerning ones self, and discovering to others the Perfections of God display'd in the Creatures, is a more acceptable act of Religion, than the burning of Sacrifices or Perfumes upon his Altars; and not onely *Trismegistus*, forbidding *Asclepius* to burn Incense, tells him, *That the Thanks and Praises of Men, are the noblest Incense that can be offered up to God:* But God himself (in his written Word) is pleas'd to say, *That he that sacrificeth Praise*

That he who sacrificeth Praise, honoureth God.

Hermes Trism. in Asclep. c. 15.

The Conclusion. (for so tis in the Original) *honoureth him.* And the Scripture
H. b. 13. 15. consonantly mentions as a very acceptable part of Religious
 Worship, the *Sacrifice of Praise, and the Calves of our Lips:*
 By offering up of which, we make that true use of the Crea-
 tures, of so referring them to their Creators Glory, that (to
 conclude this Discourse by Crowning it (as it were) with that
Rom. 11. 36. excellent Circle mention'd by the Apostle) as *all things are*
Of him, and Through him, so they may be *To him; to whom be*
Glory for ever, Amen.



THE



*The Citations Engliſhed.**Pag. 23 Seneca de Otio Sap. Cap. 32.*

‘**N**ATURE, conſcious to her ſelf of her own Beauty and
 ‘Artifice, hath given us a curious ſearching Wit, and to
 ‘ſo excellent and great ſhewes begat us to be Spectators; other-
 ‘wiſe ſhe would have loſt the Fruit of her Self, if to a de-
 ‘ſert and ſolitude ſhe ſhould have ſet forth ſo magnificent, ſo
 ‘famous, ſo finely drawn, ſo fair and many wayes beautiful
 ‘pieces. That you may know ſhe would not onely have them
 ‘ſeen but lookt upon, take notice of the place ſhe hath given
 ‘us: For ſhe hath not onely made Man of an upright Stature,
 ‘but being ſo made, for better Contemplation, that he might
 ‘follow with his Eye the courſe of the Stars, from the Riſing
 ‘to the Setting, and carry about his Looks, together with his
 ‘whole Body, ſhe hath both given him a tall Head, and placed
 ‘that upon a flexible Neck: Then ſhe ſhews fix Conſtellations
 ‘by Day, and fix by Night. She hath laid open every part of
 ‘her Self, that by thoſe things which ſhe hath offered to the
 ‘Eyes of Man, ſhe might breed a deſire of knowing the reſt.
 ‘Yet neither do we ſee all her Works, nor thoſe that we ſee
 ‘do we ſee in thoſe Proportions which they truly have: but our
 ‘Sight by ſearching, does open a way unto it ſelf, and lay the
 ‘grounds of Truth, that ſo Inquiry may paſs from things that
 ‘are plain to things that are obſcure, and find ſomewhat more
 ‘Ancient even than the World it ſelf. See *Sen. de Vita Beata*,
Cap. 32.

‘*Pag. 28.* What does he that contemplates the Nature of
 ‘the Univerſe, of Honour unto God; This, that his great
 ‘Works are not without a Witneſſe.

p. 28.

pag. 207 Sen. de Ira. cap. 27.

‘ We are not the cause of the Seasons and returns of Summer and Winter to the World: These have their own Lawes, accommodated to the Exercise of Divine Beings. We arrogate too much honour to our selves, if we esteem our selves worthy that such vast Bodies should fulfil such Motions for our sakes.

Ib. Lactantius de Ira Dei, cap. 13.

‘ True is the Opinion of the Stoicks, that say, How that for our sakes the World was made for all things that are, and the World doth by it self generate, are accommodated to the Advantage of Man.

Ib. Seneca de Benef. cap. 23.

‘ The Gods were not carelesse or unconcern’d in the making of Man, for whom they made so many other Creatures: For Nature design’d us, and drew us out in Idea, before she made us.

Ib. Cicero 2. De Nat. Deorum.

‘ And for whose sake then was the World made? for those Beings that have Reason and Intelligence, viz. Gods and Men, than whom no Being is more excellent.

pag. 414 Piso in Medicina Brasil. lib. 1.

‘ It is observable, That so many excellent Trees, Shrubs, and an innumerable company of Herbs, some few excepted, should all appear so unlike the Vegetables of the Antiently known World, both in Figure, Leaf, and Fruits: And the same Observation is made of Birds, Beasts, and Fishes, and of Insects both Flying and Creeping, which are monstrously numerous,

‘ numerous, and of unspeakable Beauty in colour, some known
 ‘ to us, and some unknown.

P. 46. *Piso* ib. ‘ You can scarce determine, whether in
 ‘ these Countries there are found more Poisons or Anti-
 ‘ dotes: The Leaves, Flowers, and Fruits of the Herbs *Tan-*
 ‘ *garack* and *Fuquer*, the two most potent Venoms of *Brasil*,
 ‘ each of these hath its proper Root for an opposite Anditote.
 ‘ The *Barbarians* apply the Fat and Heads of Vipers, and the
 ‘ whole Bodies of those Insects, prepared according to Art,
 ‘ that stung or stuck any person, and that with boldnesse and
 ‘ happy successe, to the Wounds made by them, and so by the
 ‘ Effects do attempt to prove, That in every Venom its own
 ‘ Anditote is contained.

pag. 48. *Piso*, ib.

‘ From the Root *Mandihoca*, that abounds with a very po-
 ‘ tent Poison, there is made not onely excellent Aliment, but
 ‘ even Antidote too.

pag. 59: *Ex Augustino*.

‘ You ought not to use your Eyes as a Bruit, onely to take
 ‘ notice of provisions for your Belly, and not for your Mind:
 ‘ Use them as a Man: Pry up into Heaven: See the things
 ‘ made, and enquire the Maker: Look upon those things you
 ‘ can see, and seek after Him whom you cannot see, and believe
 ‘ on Him you cannot see, because of those things you see: and
 ‘ be not like the Horse and Mule, &c.

pag. 73. *Epicurus in Epist. ad Herod. in Laertio*.

‘ As to the Meteors, you ought not to believe that there
 ‘ is either Motion, or Change, or Eclipse, or the rise or
 setting

' setting of them, because of any superior President, which
 ' doth, or hath so disposed of it, and himself possesses all the
 ' while Happinesse and immortal Life. Wherefore you must
 ' think, that when the World was made, those implications
 ' and foldings of Atoms happen'd, which caused this necessity,
 ' that these Bodies should passe through these Motions.

' There are infinite Worlds, some like this, some unlike it:
 ' For since Atoms are infinite (as I newly shewed from the infiniteness
 ' of the Spaces) some in one, other in others, distant
 ' parts of these Spaces far from us, variously concur to the making
 ' of infinite Worlds.

P. B. Lucretius, Lib. 5.

*But how at first, when Matter thus was whirl'd,
 Heaven, Earth, and Sea, the high and lower World,
 The Sun and Moon, and all were made, Ile shew.
 For sure the first rude Atoms never knew
 By sage Intelligence, and Councel grave,
 T' appoint the places that all Beings have:
 Nor will I think, that all the Motions here
 Order'd at first by fixt Agreements were,
 But th' Elements that long had beat about,
 Been buffeted, now in, now carried out:
 Screw'd into every hole, and try'd to take
 With any thing, in any place to make
 Somewhat at last; after much time and coy,
 Motions and Meetings, and a world of toy
 Made up this Funtio. And thus being joyn'd,
 And thus in kind Embraces firmly twin'd,
 And link'd together, they alone did frame,
 Heav'n, Earth, and Sea, and th' Creatures in the same.*

Pag. 77. *Aristot. Metaph. 12. c. 6.*

'How shall things be mov'd, if there be no actual cause. For
'Matter cannot move it self, but requires to be mov'd by a
'Tectonic' thing-creating Power.

Pag. 78. *Ciceronis de Thalete.*

'He said, Water was the Principle of all things, but God
'was that Intelligence, that made all things out of Water:
Ejusdem de Anaxagora. 'The delineation and manner of all
'things he thought to be design'd and made by the power and
'reason of Infinite Intelligence.

P. 78. *Garcias ab Horto, L. 1. simp. c. 47.*

'Diamonds, which ought to be brought to perfection in the
'deepest Bowels of the Earth, and in a long tract of Time,
'are almost at the top of the Ground, and in three or four
'Years space made perfect. For if you dig this Year but the
'depth of a Cubit, you will find Diamonds; and after two
'years dig there, you will find Diamonds again.

P. 284. *Arist. de Mundo, cap. 6.*

'It remains that we speak briefly concerning that Cause,
'whose power preserves and supports all things, in like man-
'ner, as we have compendiously handled other matters. For
'it would seem criminal to passe over the chief part of the
'World untouch'd, having design'd to discourse of the Uni-
'verse in a Treatise, which, if lesse accurate, yet certainly may
'be sufficient for a rough platform of Doctrine.

Ibid.

'For God is both the Preserver of all things contain'd in
'the Universe, and likewise the Producer of every Thing
'whatsoever which is in any wise made in this World: Yet not
'so as to be sensible of labour, after the manner of a Work-
'man, or a Creature, which is subject to weariness; for he is
'endued with a power which is inferior to no difficulty, and

R

whereby

‘ whereby he contains all things under his authority, even such
 ‘ as seem most distant from him.

‘ Tis more magnificent and agreeable to conceive God so
 ‘ resident in the highest place, that nevertheless his Divine
 ‘ Energy being diffus’d throughout the whole World, moves
 ‘ both the Sun and Moon, turns round the whole Globe of
 ‘ Heaven, and affords the causes of Safety and Preservation of
 ‘ such things as are upon the Earth.

‘ But to sum up all in brief ; what the Pilot is in a Ship,
 ‘ what the Driver in a Chariot, what the chief Singer is in a
 ‘ Dance, finally, what Magistracy is in a Common-wealth,
 ‘ and the General in an Army, That is God in the World:
 ‘ Unless there be this difference, That much Toil and manifold
 ‘ cares perplex them, but all things are perform’d by God
 ‘ without labour or trouble.

P. 986 Galen de plac. Hipp: & Plat. Lib. 7.

‘ Whereas therefore (saith he) all Men ascribe that to Art,
 ‘ which is made aright in all respects; but that which is onely
 ‘ in one or two, not to Art, but Fortune: The structure of
 ‘ our Body gives us cause to admire the excellent Art, Exact-
 ‘ nesse, and power of Nature which fram’d us. For our Body
 ‘ consists of above two hundred Bones ; to each of which
 ‘ tends a Vein for conveying of nourishment (in like manner
 ‘ as to the Muscles) which is accompanied with an Artery and
 ‘ a Nerve; and the parts are exactly pairs, and those plac’d
 ‘ in the right side of an Animal, are wholly alike to those in
 ‘ the other, Bone to Bone, Muscle to Muscle, Vein to Vein,
 ‘ Artery to Artery, and Nerve to Nerve ; excepting onely
 ‘ the Bowels, and some other parts, which seem to have a pe-
 ‘ culiar construction. So that the parts of our Body are
 ‘ double, and altogether alike among themselves, both in
 ‘ greatnesse and shape, as also in consistence, which I place in
 the

' the diversity of softnesse and hardnesse. As therefore we use
 ' to judg of things made by Men , acknowledging the skill
 ' of a Workman, by the building of a Ship with extraordinary
 ' Art; so also it behoveth to do in those of God, and to admire
 ' the Framer of our Body, whosoever of the Gods he were, al-
 ' though we do not see Him.

P. 99. *Arist. de Mundo.*

' Tis an ancient Tradition (saith he) diffus'd amongst all
 ' Mankind from our Ancestors, That all things were made
 ' and produc'd of God, and by God; and that no Nature can
 ' be sufficiently furnisht for its own safety, which is left without
 ' the support of God, to its own protection.

P. Ead.

' Thus therefore we ought to conceive of God: If we con-
 ' sider his Power, he is omnipotent; if his Shape, most Beauti-
 ' ful; if his Life, Immortal; and finally, if his Virtue, most ex-
 ' cellent. Wherefore though undiscernable by any corrup-
 ' tible Nature, yet He is perceiv'd by such in his Works; and
 ' indeed those things which are produc'd in the Air, by any
 ' mutation whatsoever, in the Earth, or in the Water, we
 ' ought deservedly to term the Works of God; which God is
 ' the absolute and sovereign Lord of the World, and out of
 ' whom (as saith *Empedocles* the Naturalist)

*All things beginning have, which e're shall be,
 Are present or to come, Plants, Men, and Beasts,
 And Fowl, and Fish the off-spring of the Sea.*

Pag. 100. *Arist. de Mundo, Cap. 6.*

' Tis reported, That when *Phidias*, the excellent Statuary,
 ' made the Image of *Minerva*, which is in the Castle at A-
 ' thens, he contriv'd his own Picture in the middle of her

'Shield, and fastned the Eyes of it to the Statue by so cunning
'Workmanship, that if any one were minded to take it away,
'he could not do it without breaking the Statue, and disorder-
'ing the connection of the Work. After the same manner is
'God in the World, retaining and upholding the coherence
'of all things, and preserving the safety of the Universe:
'Onely He is not in the midst of it, namely the Earth, which is
'a turbulent Region, but in the highest place, which is suitable
'to his Purity.

pag. 101, 102. *Galen de Usu partium.*

'Our most wise Creator hath plac'd under the Foot a skin,
'not loose, or thin, or soft, but close, and of indifferent hard-
'nesse and sense, to the end it might not easily suffer injury.
'To him I compose these Commentaries as certain Hymns,
'esteeming Piety not to consist in sacrificing many *Hecatombs*
'of Oxen to Him, or burning *Cassia*, and a thousand other
'Perfumes; but in this, first to know my self, and then to
'declare to others, what his VVisdom, Power, Providence,
'and Goodnesse is: the ignorance of which, not the abstaining
'from Sacrifice, is the greatest Impiety. For I account it an
'evidence of most perfect goodnesse, that He hath furnish'd all
'things with convenient Ornament, and deny'd his benefits
'to none. Now to have devis'd how all things might be
'handsomly fram'd, is the part of highest VVisdom; but to
'have made all things which he would, of insuperable Power.

pag. 104. *Paracelsus de Mineral. Tract. 1.*

'God is very admirable in his VVorks; from the Contem-
'plation of which we ought not to desist Night or Day, but
'continually be employ'd in the inquisition of them: For this
'is to walk in the wayes of God.

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OF THE
USEFULNESSE
OF
Natural Philosophy.

The Second Part.

The first SECTION.
Of its Usefulness to PHYSICK.

2

1944

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ESSAY I.

*Containing some Particulars tending to shew
the Usefulness of Natural Philosophy to the
Physiological part of Physick.*



After having, in the former part of this Treatise, *Pyrophilus*, thus largely endeavoured to manifest to You the advantagefulness of Natural Philosophy to the Mind of Man, we shall now proceed to speak of its Usefulness both to his Body and Fortune. For I must ingeniously confesse to You, *Pyrophilus*, That I should not have neer so high a value as I now cherish for Physiology, if I thought it could onely teach a Man to discourse of Nature, but not at all to Master Her; and served onely, with pleasing Speculations to entertain his Understanding without at all increasing his Power. And though I presume not to judge of other Mens Knowledge: yet, for my own particular, I shall not dare to think my selfe a true Naturalist, till my skill can make my Garden yeeld better Herbs and Flowers, or my Orchard better Fruit, or my Field better Corn, or my Dairy better Cheese than theirs that are strangers to Physiologie. And certainly, *Pyrophilus*, if we seriously intend to convince the distrustful World of the real usefulness of Natural Philosophy, we must take some such course, as that *Milesian Thales* did, who was by the Anti-

The advantage
of the Knowledge
of Nature to-
wards the in-
creasing the
power of Man;
and its use as to
health of the
Body, & Goods
of Fortune.

ents reckoned among the very first of their Naturalists, and their seven celebrated Wise men. Of this *Thales* it is reported, That being upbraidingly demanded what advantage the Professors of Astrology could derive from the knowledge of it; he Astrologically foreseeing what a Year it would prove for Olives, before any wonted signs of it did appear to Husbandmen, ingrossed, by giving earnest, the greater part of the Olives, which the next Season should afford to *Chios* and *Miletus*, and being thereby enabled, when most men wanted Oyl, to sell his at his own rates, he made advantage enough of his skill, to let his friends see, That Philosophers may have the acquisition of Wealth more in their power than in their aim.

That in Mans knowledge of the nature of creatures consists his Empire over them.

Me thinks, it should be a Disparagement to a Philosopher, when he descends to consider Husbandry, not to be able, with all his Science, to improve the precepts of an Art, resulting from the lame and unlearned Observations and Practice of such illiterate persons as Gardners, Plowmen, and Milkmaids. And indeed, *Pyrophilus*, though it be but too evident, that the barren Philosophie, wont to be taught in the Schooles, hath hitherto been found of very little Use in Humane life; yet if the true principles of that fertill Science were thoroughly known, considered and applied, tis scarce imaginable, how universal and advantageous a change they would make in the World. For in Man's knowledge of the Nature of the Creatures, doth principally consist his Empire over them, (his Knowledge and his Power having generally the same Limits.) And as the Nerves, that move the whole Body, and by it, that great variety of Engines employed by Man on his manifold occasions, proceed from the Brain; so all the operations, by which we alter Nature, and produce such changes in the Creatures, flow from our knowledge of them. Theological Inquiries excepted, there is no Employment wherein Mankind is so much and so generally concerned,

tis in the study of Natural Philosophie. And those great Transactions which make such a Noise in the World, and establish Monarchies or ruine Empires, reach not so many persons with their influence, as do the Theories of Physiology.

To manifest this Truth, we need but consider what changes in the Face of things have been made by two Discoveries, trivial enough; the one being but of the inclination of the Needle, touched by the Load-stone, to point toward the Pole; the other being but a casual Discovery of the supposed Antipathy between Salt-Petre, and Brimstone: For without the knowledge of the former, those vast Regions of *America*, and all the Treasures of Gold, Silver, and precious Stones, and much more precious Simples they send us, would have probably continued undetected; And the latter giving an occasional rise to the invention of Gunpowder, hath quite altered the condition of Martial Affairs over the World, both by Sea and Land. And certainly, true Natural Philosophy is so far from being a barren Speculative Knowledge, that Physick, Husbandry, and very many Trades (as those of Tanners, Dyers, Brewers, Founders, &c.) are but Corollaries or Applications of some few Theorems of it.

If I had not a great Respect for the Great *Hippocrates*, I should venture to say, That some of those rigid Laws of *Draco* (whose Severity made Men say, That they were written in Blood) have, perhaps, cost fewer persons their Lives, than that one Aphorisme of *Hippocrates*, which teaching, *That if a Teeming Woman be let blood, she will miscarry*, has for divers Ages prevailed with great numbers of Physicalls, to suffer multitudes of their Female Patients to die under their Hands, who might probably have been rescued by a discreet Phlebotomy, which Experience hath assured us (whatever the close of the Aphorism says to the contrary) to have been sometimes not only safely, but usefully employed, even when the Infant

That the discovery of *America* is owed to the knowledge of the Loadstones Polarity.

That the Martial affairs all over the World were altered by the knowledge of the nature of Brimstone and Salt-peter.

How prejudicial the mistake of that Aphorism (*That if teeming Women be let blood, they will miscarry*) hath been to several patients.

* Hipp. Aph. I. 5.
Γυνή ἐὰν αἵσεται
ἐχέτω, φλεβο-
τομήν αὐτῇ ἐκτε-
ραχέει καὶ μὴ λ-
λόν ἢ μὴ ζῶν
ἴσῃ τὸ αἷμα.

is grown pretty big. But my respect for so great a Person as *Hippocrates*, makes me content it should be thought, That till of late, Physicians have for the most part mistaken their Dictator's meaning in this Aphorisme, provided it be granted me, That through this mistake numbers of teeming Women have been suffered to perish, who might probably, by the seasonable loss of some of their Blood, have prevented that of their Lives.

And if an Error, which occasioned onely a fault of omission, hath been so prejudicial to Man-kind, I suppose you will readily grant, that those Errors of Physicians, that are apt to produce faults of commission, and rash attempts, may prove much more hurtful. And so much I find to be acknowledged by *Galen*, in that honest and excellent passage of his, in his Comment upon the Aphorismes, where having mentioned the danger of trying Conclusions upon Men, by reason of the nobleness of the Subject; and having added, That the Physicians Art is not like that of a Potter, a Carpenter, or the like, where a Man may freely try what he pleases to gratifie his Curiosity, or satisfie himself about his Notions, because that if he spoils (for instance) the Wood he works on, no Body is endangered by his miscarriage: He thus concludes, *In corpore autem Humano ea tentare, qua non sunt experientium comprobata periculo non vacat; cum temeraria experientia finis sit totius Animantis internecio.*

Comment. in
Aph. 1. lib. 1.

The interest of
this knowledg to
the happines &
life of Man.

And indeed, since the Physician borrows his Principles of the Naturalist, I cannot but somewhat admire to see diverse Persons, who are by themselves and others thought such wise Men, think the study of Natural Philosophie of small concernment: for when by their Policy or good Fortune they have acquired never so much Wealth or Power, and all other transitory Goods, and are blest with Children to inherit them, if the principles of Natural Philosophy be mislaid, we oftentimes see the Ignorance or the Mistake of a Doctor, deprive them

them of all at once, and shew how dangerous it is to be solicitous of the means of attaining the accommodations of Life, with the contempt of that Knowledge which in very many cases is humanely necessary to the preservation of Life it self.

But, *Pyrophilus*, though our unintended prolixity in the former part of our Discourse concerning the Usefulness of Physiology, oblige us to the greater brevity in this latter part of it; yet to shew you, That of the two things, which you may remember we told You, *Pythagoras* pronounced most God-like in Man, (*The Knowledge of Truth, and the Doing of Good,*) Physiology as well qualifies us for the latter, as it enriches us with the former. It will not be amiss a little more particularly (though as succinctly as so copious a Subject will permit) to consider the probability there is that no small Improvement may be made by Mens proficiency in Experimental Knowledge of those Arts, which are the chiefest Instruments of Man's Dominion over the Creatures. These Arts (to divide them not accurately, but popularly) do serve either to relieve Man's necessities, as Physick and Husbandry; or for his accommodation, as the Trades of Shoo-makers, Diers, Tanners, &c. or for his Delight, as the Trades of Painters, Confectioners, Perfumers, &c. to all which Arts, and many others ally'd to them, Philosophical Experiments and Observations, may, by a knowing Naturalist, be made to extend a meliorating Influence.

If I should, *Pyrophilus*, say this, without offering any thing at all by way of Proof that I say it not inconsiderately, You would, I fear, believe, that I deliver it too slightly for a Matter of that Moment: And if, on the other side, I should in this Discourse present to you all the particulars that I think I could without impertinency employ, to countenance what I have said, it would swell this Treatise to a Volume, and defraud divers of my other Essays. And therefore I hold it not unfit

The enumeration of those Arts to which this knowledge is profitable.

The method or way intended for the ensuing Discourse.

unfit to choose a middle way, and set down, on this occasion, either onely or chiefly those things which do the most readily occur to me, and do not so properly belong to the rest of my Physiological Papers. And to avoid Confusion, I shall, according to the Division newly proposed, employ one Section of this Second part of the present Treatise, in setting down such things as relate to the improvement of Physick. And in the other Section, deliver such particulars as concern those other useful Arts that depend upon Natural Philosophy. But in regard that (as I have already intimated) the following Discourse is to consist chiefly of those things that belong not to any of my other Essayes, You will not, I presume, expect that I should handle any Subject fully or methodically on this occasion: Which warning I especially intend for that part of the ensuing Discourse that relates to Physick. For You will easily believe, that I am far from pretending to be a Doctor in that Faculty: And accordingly, in this and the four following Essayes, I shall onely throw together divers such particulars as, not belonging to my Writing, would, perhaps, be lost, if I did not lay hold on this Opportunity for their preservation, of which they are not altogether judged unworthy by some knowing men, whose Encouragements, to mention them to You, have dissuaded me from wholly passing by, in this Discourse, Matters properly Medical, what scruples soever I had to venture at speaking of them: Especially since I have not now the Conveniency to furnish these Essayes with divers particulars (by some thought not inconsiderable) which I may perhaps be invited to add to them hereafter, if I find by Your Reception of these that the others are like to be welcom.

The division of
Physick in five
parts.

To say something then of Physick, and to suppose the fitnessse of the now received Division of it into five parts: The Physiological, (the Physician taking that in a stricter sense than Philosophers, and than we do every where, save in this Essay.)

Patholo-

Pathological, Semeiotical, Hygieinal, and Therapeutical, let us briefly take notice how each of these is indebted to, or capable of being improved by experienc'd Naturalists. And indeed, such is the affinity between Natural Philosophy and Physick, or the dependance of this on that, that we need not wonder at the judicious Observation of *Aristotle*, where he thus writes, *Naturalium ferè plurimis & Medicorum, qui magis Philosophicè artem prosequuntur, illi quidem finiunt ad ea, quæ de Medicina; hi verò ex iis quæ de Natura, incipiunt quæ de Medicina;* But we must instance these things more particularly: And first for Physiology, 'tis apparent, That the Physician takes much of his Doctrine in that part of his Art from the Naturalist: And to mention now no other parts of Physiology, in its stricter acception, the experience of our own age may suffice to manifest, what light the Anatomical doctrine of Mans Body may receive from Experiments made on other subject. For since it were too barbarous, and too great aviolation of the Laws, not only of Divinity but Humanity, to dissect humane Bodies alive, as did *Herophilus* and *Erasistratus*, who (as I finde in some of the Ancients) obtained of Kings the Bodies of Malefactors for that purpose, and scrupled not to destroy Man to know him; And since, nevertheless divers things in Anatomy, as particularly the motion of the Blood and Chyle cannot be discovered in a dead dissected Body (where the cold hath shut up and obliterated many Passages) that may be seen in one opened alive; it must be very advantageous to a Physicians Anatomical knowledge, to see the Dissections of Dogs, Swine, and other live Creatures, made by an inquisitive Naturalist: Consonantly whereunto we may remember, that the discoveries of the milky Vessels in the Mesentery by *Asellius*, of those in the *Thorax* by *Pecquet*, and of the *Vasa Lymphatica* by *Bartholinus*, were first made in Brute Bodies, though afterwards found to hold in humane

Arist. lib. de sensu & sensu, cap. 1

How the Physiological part of Physick is advantaged by the knowledge of natural Philosophy.

That the Anatomical doctrine of mans body receives light from experiments made on other creatures.

Proved by divers instances: as of the finding the lacteals and lymph ducts in brut bodies first.

humane ones. Nor is it a small convenience to the Anatomist, that he may in the Bodies of Brutes make divers instructive Experiments, that he dares not venture on in those of Men; as for instance, that late noble, and by many not yet credited Experiment of taking out the Spleen of a Dog without killing him: For that this Experiment may be very useful, we may elsewhere have occasion to shew. And that it is possible to be safely made) though many, I confess, have but unprosperously attempted it. and it hath been lately pronounced impossible in Print) our selves can witness. And because I have not yet met with any Author that professes himself not to relate this Experiment (of the exemption of a Dogs Spleen) upon the credit of others, but as an eye-witness, I am content to assure you, That that dextrous Dissector, Dr *Folivet* (of whom we formerly made mention) did the last Year, at my request, take out the Spleen of a yong Setting-dog I brought him: And that it might not be pretended, the Experiment was unfaithfully or favourably made, I did part of it myself, and held the Spleen (which was the largest in proportion to his Body that ever I saw) in my Hand, whilst he cut asunder the Vessels, reaching to it, that I might be sure there was not the least part of the Spleen left unextirpated, and yet this Puppy, in lesse then a Fortnight, grew not only well, but as sportive and as wanton as before: which I need not take pains to make you beleive, since you often saw him at your Mothers House, whence at length he was stoln. And though I remember the famous Emperick *Fioravanti*, in one of his *Italian* Books, mentions his having been prevailed with by the importunity of a Lady (whom he calls *Marulla Greca*) much afflicted with Splenetick distempers, to rid her of her Spleen, and adds, That she out-lived the loss of it divers Years. Yet he that considers the situation of that part, and the considerableness of to Vessels belonging to it in humane Bodies, will probably

The Experiment of taking out the Spleen in Dogs.

The same thing done by *Fioravanti* in a Woman.

probably be apt to think, that though his relation may be credited, his venturousnesse ought not to be imitated. The Experiment also of detaining Frogs under Water for very many hours (sometimes amounting to some dayes) without suffocation, may, to him that knows that Frogs have Lungs and Breath as well as other Terrestriall Animals, appear a considerable discovery, in order to the determining the Nature of Respiration. Besides, the scrupulousnesse of the Parents or Friends of the deceased Persons, deprives us oftentimes of the Opportunities of Anatomizing the Bodies of men, and much more those of Women; whereas those of Beasts are almost alwaies and every where to be met with. And 'twas, perhaps, upon some such account, that *Aristotle* said that the external parts of the Bodie were best known in Men, the internal in Beasts, *Sunt enim* (sayes * he, speaking of the inward parts) *hominum imprimis incerta atque incognita: quamobrem ad ceterorum animalium partes quarum similes sunt humana referentes eas contemplari debemus.* And questionless in many of them, the frame of the parts is so like that of those answerable in men, that he that is but moderately skill'd in Anatomy (as some of the Moderns call the Dissection of Mans Body, to distinguish it from Zootomy, as they name the Dissections of the Bodies of other Animals) may, with due diligence and industry, not dispicably, improve his Anatomical knowledge. In confirmation of which truth, give me leave to observe to you, That though *Galen* hath left to us so many, and by Physicians so much magnified Anatomical Treatises, yet not only divers of those Modern Physicians, that would eclipse his Glory, deny him to have learn'd the skill he pretends to, out of the inspection of the Dissected Bodies of Men or Women, or so much as to ever have seen a humane Anatomy. But I finde even among his Admirers, Physicians that acknowledge that this Knives were much more con-

The respiration of Frogs divers hours, sometimes dayes, under water, without suffocation.

* *Arist. Hist. lib. 1. cap. 16.*

What use *Aristotle* and *Galen* made of the dissections of Brutes.

Anatomy of
Man counted
now in Mus-
covy for inhu-
mane; And the
use of Skele-
tons for Witch-
craft.

*Voyage de Mus-
covie & de
Perse, pag. 128.*

The use of the
comparison of
the parts of hu-
mane Body
with those of
Beasts.

Illustrated by
divers particu-
lar Observati-
ons.

versant with the Bodies of Apes, and other Brutes, then with those of Men, which in his time those Authors say 'twas thought little lesse then Irreligious, if not Barbarous, to man- gle; which is the lesse to be wondred at, because even in this our Age that great People of the Muscovites, though a Christian and European Nation hath deny'd Physitions the use of Anatomy and Skeletons; the former, as an inhumane thing; the latter, as fit for little but Witchcraft, as we are informed by the applauded Writer *Olearius*, Secirary to the Embassie lately sent by that Learned Prince, the present Duke of *Holsteine*, into *Muscovia* and *Persia*. And of this, the same Author gives us the instance of one *Quirin*, an excellent German Chyrurgian, who, for having been found with a Skeleton, had much adoe to scape with his Life, and was commanded to go out of the Kingdome, leaving behind him his Skeleton, which was also dragged about, and afterwards burnt.

To these things we may adde, *Pyrophilus*, that the diligence of Zootomists may much contribute to illustrate the Doctrine of *Andratomy*, and both informe Physicians of the true use of the parts of an humane Body, and help to decide divers Anatomical Controversies. For as in general 'tis scarce possible to learn the true Nature of any Creature, from the consideration of the single Creature it self: so particularly of divers parts of an humane Body 'tis very difficult to learn the true use, without consulting the Bodies of other Animals, wherein the parts inquired after is by Nature either wholly left out as needlesse, or wherein its differing bignesse, or situation, or figure, or connection with, and relation to other parts, may render its use more conspicuous, or at least more discernable.

This Truth may be somewhat illustrated by the following Observations, which at present offer, themselves to my thoughts upon this occasion.

The Lungs of Vipers, and other Creatures (whose Hearts
and

and whose Blood, even whilst it circulates, we have alwayes found, as to sense, actually cold) may give us just occasion to inquire a little more warily whether the great use of Respiration be to coole the Heart.

The suddain falling and continuing together, which we may observe in that part at least of a Dogs Lungs, that is on the same side with the Wound, upon making a large Wound in his Chest, though the Lungs remain untouched, is a considerable Experiment, in order to the discovery of the principall Organ of Respiration.

- If you dexterously take out the Hearts of Vipers, and of some smaller Fishes, whose coldnesse makes them beat much more unfrequently and leisurely, then those of warme Animals, the contraction and relaxation of the Fibres of the Heart may be distinctly observed, in order to the deciding or reconciling the Controversie about the cause and manner of the Hearts motion, betwixt those Learned modern Anatomists, that contend, some of them, for Dr. *Harvey's* Opinion; and others, for that of the Cartesians.

Towards satisfying my selfe in which difficulty, I remember, I have sometimes taken the Heart of a Flownder, and having cut it transversly into two parts, and pressed out, and with a Linnen cloth wiped off the Blood contain'd in each of them, I observ'd, that for a considerable space of time, the sever'd and bloodlesse parts held on their former contraction and relaxation. And once I remember that I observed, not without Wonder, That the sever'd portions of a Flownders Heart, did not onely, after their Blood was drain'd, move as before, but the whole Heart, observ'd for a pretty while, such a succession of motion in its divided and exsanguious pieces, as I had taken notice of in them whilst they were coherent, and as you may with pleasure both see and feel in the intire Heart of the same Fish.

Some

Some of the other Controversies agitated among Anatomists and Philosophers, concerning the use of the Heart, and concerning the principal seat of Life and Sense, may also receive light from some such Experiments, that we made in the Bodies of Brutes; as we could not of Men.

Divers motions
and Actions of
Frogs after
their hearts
were cut out.

And the first of these that we shall mention, shall be an Experiment that we remember our selves formerly to have made upon Frogs: For having opened one of them alive, and carefully cut out his Heart, without closing up the Orifice of the Wound (which we had made wider then was necessary) the Frog notwithstanding leaped up and down the Room as before, dragging his Entrails (that hung out) after him; and when he rested, would upon a puncture leap again, and being put into the Water, would swim, whilst I felt his Heart beating betwixt my Fingers. The Hearts of others of them were taken out at an Incision, no greater then was requisite for that purpose; when we had stitched or pin'd up the Wound, we observed them to leap more frequently and vigorously then the former: They would, as before they were hurt, close and open their Eye-lids upon occasion: Being put into a Vessel not full of Water, they would as orderly display their fore and hinder Legs in the manner requisite to swimming, as if they wanted none of their parts, especially not their Hearts; they would rest themselves sometimes upon the surface of the Water, sometimes at the bottom of it, and sometimes also they would nimbly leap, first out of the Vessel, and then about the Room, surviving the extraction of their Hearts; some about an hour, and some longer. And that which was further remarkable in this Experiment, was, that we could, by gently pressing their Breast and Belly with our Fingers, make them almost at pleasure make such a noise, as to the By-standers made them seem to croak; but how this Experiment will be reconciled to the Doctrine ascribed to Mr *Hobbs*, or to that

that of the *Aristotelians*, who tell us, That their Master taught, the Heart to be the seat of Sence (whence also though erroneously, he made it the original of the Nerves) let those that are pleased to concern themselves to maintain all his Opinions, consider.

And whereas Frogs, though they can move thus long without the Heart, yet they cannot at all bear the exemption or spoiling of the Brain; we will adde what we have observed, even in hot Animals, whose Life is conceived to be much more suddenly dissipable, and the motion of each part much more dependent upon the influence of the Brain: We opened then an Egg, wherein the Chick was not only perfectly formed, but well furnished with Feathers, and having taken him out of the Membrane that involved him, and the Liquors he swam in, and laid him on his Back on a flat piece of Glass, we clip'd away, with a pair of Scissers, the Head and the Brest-bone; whereby the Heart became exposed to view, but remained fastned to the Headlesse Trunk: and the Chick lying in this posture, the Heart continued to beat above a full hour, and the Ears seemed to retain their motion a pretty while after the Heart it self had lost his; the motion of none of the other Parts appearing many moments to survive the losse of the Head: and which is most considerable, the seemingly dead Heart was divers times excited to new, though quickly ceasing motion, upon the puncture of a Pin, or the point of a Pen-knife. And to evince that this was no casual thing, the next Day we dealt with the Chick of another Egg, taken from the same Hen, after the above recited manner; and when the motion of the Heart and Ears began to cease, we excited it again, by placing the Glass over the warm steam of a Vessel full of hot Water, bringing still new Water from off the Fire to continue the heat, when we perceived the former Water to begin to cool, and by this means we kept the Heart beating for

Observations
of the Motion of
a Chickens
heart after the
head and other
parts were cut
off.

Of the vivacity of dissected Vipers:

for an hour and an half by measure. And at another time for further satisfaction, we did, by these and some other little industries, keep the Heart of a somewhat elder Chick, though exposed to the open Air, in motion, after we had carefully clipt off the Head and Neck, for the space of (if our memory do not much mis-inform us) two hours and an half by measure. Upon what conjectures we expected so lasting a motion in the Heart of a Chick, after it had lost the Head, and consequently the Brain, would be more tedious and less fit to be mentioned in this place, then the strange vivacity we have sometimes, not without wonder, observed in Vipers: Since not onely their Hearts clearly sever'd from their Bodies may be observ'd to beat for some hours (for that is common with them to divers other cold Animals) but the Body it self may be sometimes two or three dayes after the skin, Heart, Head, and all the Entrals are separated from it, seen to move in a twining or wrigling manner: Nay (what is much more) may appear to be manifestly sensible of punctures, being put into a fresh and vived motion, when it lay still before, upon the being pricked, especially on the Spine or Marrow with a Pin or Needle.

And Tortoises,

And though Tortoises be in the Indies many of them very large Animals, yet that great Traveller *Vincent le Blanc*, in his French Voyages, giving a very particular account of those Tortoyses, which the East Indian King of *Pegu* (who was much delighted with them) did, with great curiosity, cherish in his Ponds, addes this memorable Passage as an Eye-witnesse of what he relates: *When the King hath a mind to eat of them, they cut off their heads, and five days after they are prepar'd, and yet after those five days they are alive, as we have often experienced.* Now although I will not say, that these Experiments prove, that either 'tis in the Membrane that sensation resides (though I have sometimes doubted whether the

Nerves

Nerves themselves be not so sensible, chiefly as they are invested with membranes) or that the Brain may not be confined to the Head, but may reach into the rest of the Body, after another manner than is wont to be taught: Yet it may be safely affirm'd, that such Experiments as these may be of great concernment in reference to the common Doctrine of the necessity of unceasing influence from the Brain, being so requisite to Sense and Motion; especially if to the lately mentioned particulars we add on this occasion what we have observ'd of the Butter-flies, into which Silk Wormes have been Metamorphosed, namely, That they may not onely, like common Flies, and divers other winged Insects, survive a pretty while the losse of their Heads, but may sometimes be capable of procreation after having lost them: as I not long since tryed (though not perhaps without such a Reluctancy as *Aristotle* would have blam'd in a Naturalist) by cutting off the Heads of such Butter-flies of either Sex. *Quamvis enim Mas cui prius amputatum est caput nequaquam adduci posset (quacunq; Insecti illius est salacitas) ut fœminam comprimeret: Decollata tamen Fœmina marem alacriter admisit. Et licet post horas aliquot coitu insumptas ita requierit immota, ut mortuam per multas horas cogitarem, non solum quia omnem penis motum perdiderat, & in Thorace satis magnum apparebat foramen, quod a parte aliqua Corporis simul cum capite à trunco disrupta factum videbatur; verum etiam quoniam eodem permansit statu idq; per plures horas, ultra tempus quo post coitionem cum Mare hujus generis Animalcula solent ordiri prolificationem. Tandem vero postquam jam diu de Vita ejus desperatum esset, Ova fœtare tam cœnferim caput, ut vel exiguo temporis intervallo eorum plura in manu mea deponeret. An verò prolifica sint futura nondum comperi.*

Whether there be a necessity of the unceasing influence of the brain to sense and motion.

That the Silkworm-butterfly is capable of procreation after the losse of its head.

Their Opinion that ascribe the rednesse of the Blood to the colour of the Liver, through which it passes, is not discour-

That the red-
ness of the
blood is not to
be ascribed to
the liver, prov-
ed by the inspe-
ction of the li-
ver of Chickens
unhatcht.

renanced by the Livers of Men: But in Hen-Eggs, about the third or fourth day after incubation (for we have found the circumstances of time much to vary) you may observe the *Punctum saliens*, or Heart, to be ever and anon full of conspicuously red Blood, before the naked Eyes can so much as discern a Liver, at least before they can discover in it any redness; a yellownesse being all I could observe in the *Parenchyma* of the Livers of divers Chickens perfectly form'd, and turnish'd with Feathers, though not great enough to make their way out of the Shell. And in divers great Fishes I have found the Vessels of the Liver full of very red Blood, though the *Parenchyma* or substance of it were white, or at least did not at all participate, much lesse impart a sanguine colour.

That the loss of
a Limb in all
Animals is
not irreparable.

The Doctrine so unanimously delivered by Physicians and Chirurgions, concerning the irreparable losse of the Limb of an animal, once violently severed from the Body, will appear unfit to be admitted, without some restriction, by what may be experienced in Lizards, in Lobsters, and Craw-fishes, and perhaps in some other living Creatures. For of Lizards it hath been often observ'd in hot Countries, and even in *France*, that their Tailles being struck off will grow again. And the like hath been of old observ'd by *Pliny*; and the experienc'd *Bontius* delivers it upon his own knowledge in these words: *Hoc in domesticis meis non semel animadverti dum filioli mei lussit abundi bacillo caudas iis decutiebant, quas tamen post diem unum aut alterum ad solitum pabulum revertentes vidi, caudasq; iis paulatim reaccrescere.*

That the Clawes likewise of Lobsters being torn off, another will sometimes grow in the room of it, is not onely said by Fisher-men, but hath been affirmed to me by very credible persons, one of which assured me, that he himself had observed it very often. And I am the more apt to believe it, because the like is to be met with among Craw-fishes, which

which are so like Lobsters , that by many they are taken (though not considerably enough) to be but a smaller kind of them. For I remember, that going to look upon a Repository where a multitude of them was kept, and causing divers of the fairest to be thrown up, that I might take the stony Concretions, commonly called *Oculi Cancrorum*, out of their heads; I observ'd one large Fish that had one of his Claws proportionable to the bulk of his Body, but the other so short and little, that the greater seem'd to be four or five times as big as it; whereupon its good shape and fresh colour seeming to argue it to be but young and growing, invited me to ask one of them that had the oversight of the Fish , whether he had formerly seen any Claws torn off to grow again, he affirmed to me, that in that sort of Fish it was very usual.

I could also tell You how fruitlessly I have endeavour'd to discover that stomachical Acidity, to which many of our Modern Physicians are pleas'd to ascribe the first Digestion of the Nutriment of Animals, in the purposely dissected Stomachs of ravenous Sea-fishes , in whose Stomachs though our Taste could not perceive any sensible Acidity, yet we found in one of them a couple of Fishes, each of them about a Foot long, whereof the one, which seem'd to have been but newly devour'd, hath suffered little or no alteration in the great Fishes Stomach; but the other had all its outside, save the Head, uniformly wasted to a pretty depth, beneath the former surface of the Body, and lookt as if it had been not boil'd, or wrought upon by any considerable heat, but uniformly corroded, like a piece of Silver Coin kept a while in *Aqua fortis*, according to the Criminal tricks of Adulterators of Money.

Yet I am loth, till I have perfected what I design in order to that enquiry , either to embrace or reject the Opinion I find so general among the Moderns, concerning the Solution of Meat in the Stomach by something of Acid. And I remem-

That notwithstanding the great solution and digestion of Meat in the Stomachs of Fishes, no sensible Acidity is found there.

Experiments
concerning the
solution of
Meats, and their
change of co-
lours by acid
Menstruums.

ber, that when I was considering what might be alleadged for, as well as against that Opinion, I devised this Experiment, among others, in favour of it. I provided a Liquor, with which I drench'd a piece of a wing of a roasted Pullet, having first well crushed it between my fingers, to make some amends for the omission of chewing it; and having a little incorporated the Liquor and the Musculous flesh, they immediately changed colour, and in about an hour grew to be a kind of Gelly, in colour and consistence not unlike Quince Marmalade. This Mixture, by the next morning, did, as I expected, turn to a deep Bloud-red, or sometimes rather a lovely purple Liquor, though all this while there had been no external heat employed to promote the Action of the *Menstruum*. And the like Experiment I tryed also with a piece of Mutton, with Bread, and a piece of Veale, and other edible things, which at that time occur'd to me, and found the Operation of the Liquor almost uniform, though it seem'd to act most effectually upon Flesh. And to gratifie in some measure your Curiosity, *Pyrophilus*, I am content to tell You, that the *menstruum* was drawn from Vitriol, and that with the bare oyl of it I have (though I could not with *Aqua fortis*) perform'd no lesse than what I have yet mentioned; but lest this should be thought a Digression, let it suffice to have, on this occasion, mention'd thus much upon the by.

To what we lately took notice of concerning the Heart, may be added, That on the Sea-coast of *Ireland*, I observ'd a sort of Fishes about the bignesse of Mackrels, whose Hearts were of an inverted figure, compar'd to those of other Animals; the basis or broad end of the Heart bein nearest the Tail, and the acuminate part or apex being coherent to the great Artery, and respecting the Head.

To all these trifling Observations, divers more considerable ones might be added, but they may be more seasonably insist-
ed

ed on elsewhere; and those already mentioned, may suffice to let You see, That the Naturalist his Zootomy may be very serviceable to the Physician in his Anatomical Inquiries.

Nor is it onely by the dissection of various Animals, that the Naturalist may promote the Anatomists knowledge, but perhaps also he may do it by devising wayes to make the dead Bodies of men, and other Animals, keep longer than naturally they would do: For since Experience teaches us, That Men find it very easie to forget the Originations, Windings, Branchings, Insertions, and other Circumstances of particular Vessels, and other parts of the Body, as well as those that study Botanicks, are wont to complain of their easie forgetting the Shapes, Differences, and Alterations of smaller Plants, it cannot but be a great help to the Student of Anatomy to be able to preserve the parts of humane Bodies, and those of other Animals, especially such Monsters as are of a very singular or instructive Fabrick, so long that he may have recourse to them at pleasure, and contemplate each of them so often and so considerately, till he have taken sufficient notice of the shape, situation, connection, &c. of the Vessel, Bone, or other part, and firmly impressed an *Idea* of it upon his memory. We find our selves much help'd to retain in our memory, the figures and differences of Vegetables, by those Books which some curious Botanists make, wherein the plants themselves, artificially dried, are display'd upon, and fastned to Leaves of white Paper. If it were not for one of those Books, wherein I have in one vast Volume almost all the Plants of one of the chief Physick-Gardens in *Europe*, I should every Year forget, by the end of Winter, to know again most of the smaller Plants I had learn'd to take notice of in the Spring: And by the way tis observable, how long Plants, by being carefully indeed, but barely dried in the shade betwixt sheets of Paper, which help to soak up the superfluous Moisture,

Wayes of Artificial drying
and preservation
of plants.

may be preserv'd. For I have divers Years had an Herbal, wherein several of the Flowers, and other Plants, retain their native yellow and blew, &c. (but somewhat faint) though by the Date it appear'd to be 22 or 23 Years old. And I am apt to think, that it would be very possible for Anatomists also to preserve the Bodies they contemplate for a considerable time: For Experience hath inform'd us in good number of such Animals, that Butter-flies, and divers other flying Insects, may have their shape and colours preserv'd, I know not how long, by running them through in some convenient part with Pins, and therewith striking them to the inside of large Boxes. And on this occasion, I remember, that having sometimes reflected upon the lasting of Spiders, Flies, and other small living Creatures, that having been casually enclosed in Amber whilst it was soft, are ever preserv'd entire and uncorrupted, I thought it not amiss to try whether some substance, like Amber (at least as to the newly mentioned use of it) might not easily be prepar'd by Art: and hereupon I quickly found, that by taking good clear *Venice* Turpentine, and gently evaporating away about a third part of it (sometimes more, sometimes lesse, according to the exigency of my particular purpose) I could make a reddish Gum, diaphanous and without Bubbles, which would melt with a very gentle heat, and easily (being suffered to coole) become again so hard as to be brittle. This resinous Substance should be melted with as little Heat as is possible, (and therefore should be first powder'd) that the texture of the Vegetable or Animal bodies to be cas'd over with it, might receive the lesse alteration: And when it is brought to the requisite degree of Fluidity, then the Body to be preserv'd (being, if that be needful, struck through with a Pin) must be gently plung'd into it, and presently taken out and suffer'd leisurely to cool, being turn'd from time to time this way or that way, if there be occasion, that the investing Mat-

And Insects.

ter may be every where of an equal thicknesse upon it. And if at the first time the Case be not thick enough, it may again when it is cold, be immersed into the liquid Matter, (as Chandlers are wont to thicken their Candles, by dipping them frequently into melted Tallow) of which some will every way adhere to it. And though these cases be inferior to Amber, in regard of their being more apt to be sullied by dust, or otherwise, yet that inconvenience may be easily remedied, by keeping them shut up in Glasses or Boxes, at those times when one hath not occasion to consider them. And their clearnesse (especially if they be thin) and their smooth surfaces, together with their exactly keeping out the Air from the Body they enclose, may, perhaps, make so cheap and easie an Experiment a not unwelcome trifle, especially considering how easily tis capable of Improvement.

But to return to the Preservation of more bulky Bodies, tis a known thing, to the Collectors of Rarities, that the external *Idea* of Fishes, Crocodiles, Birds, and even Horses, may be preserv'd for many Years, by taking out the more corruptible parts, and stuffing their prepared skins with any convenient matter. And that the internal membranous parts of Bodies may be long and easily kept from putrefaction, is not unknown to many Anatomists. And not to mention what we have tried of this sort, we have seen the Veins, Arteries, and Nerves of a humane Body, laid out in their natural situation upon three Boards, by the pains and skill of an accurate Anatomist of *Padua*. And elsewhere, *Uterum vidimus atq; omnia mulieris genitalia*, together with the Bladder, all displai'd upon a Board, preserved for many Years so entire, and in a situation so near the Natural, that this Scheme was far more instructive, than the most accurate Printed one could possibly be. We have likewise known the flesh of Vipers, kept not onely sweet, but efficacious, for divers Years, by the smoak of a peculiar

And more bulky Bodies,

Particularly the Schemes of divers parts of humane body,

liar Powder, chiefly consisting of Aromatick Ingredients, and of which You, *Pyrophilus*, may command the Composition.

We have also seen the Skeleton of a Monky, made by an excellent French Chirurgion of our Acquaintance, whereon the Tendons and Fibres of the Muscles were so preserved, that it was looked upon as a rarity, very useful to shew their Originations and Insertions, and to explain the motions of the Limbs: And perhaps there may be some way to keep the Arteries & the veins too, when they are emptied of blood, plump, and unapt to shrink overmuch, by filling them batimes with some such substance, as, though fluid enough when it is injected to run into the Branches of the Vessels, will afterwards quickly grow hard. Such may be the liquid Plaister of burnt Alabaster, formerly mentioned, or Ising-glasse steeped two dayes in Water, and then boil'd up, till a drop of it in the Cold will readily turn into a still Gelly. Or else *Saccarum Saturni*, which if it be dissolved often enough in Spirit of Vineger, and the Liquor be each time drawn off again, we have observed to be apt to melt with the least heat, and afterwards to grow quickly into a somewhat brittle consistence again. But I must not insist on these Fancies, but rather adde, That I have known an *Embrio*, wherein the parts have been very perfectly delineated and distinguishable, preserved unputrified for several Yeares; and I think it still continues so, by being seasonably and artificially embalmed with Oyl (if I much mis-remember not) of Spikes. And I have elsewhere seen a large *Embrio*, which after having been preserved many Years, by means of another Liquor (whose Composition I doe as yet but guesse at) did, when I saw it, appear with such an admirable Entirenesse, Plumpnesse, and Freshnesse, as if it were but newly dead: And that which concurs to make me hope that some nobler way may be yet found out, for the preservation of dead Bodies, is that I am not convinc'd that nothing can powerfully resist Putrefaction

Of the preservation of an *Embrio* divers years by embalming it with oyl of Spike.

refaction in such Bodies, but things that are either Saline and Corrolive, or else Hot; nor that the Embalming Substances cannot be effectually applied, without ripping open the Body to be preserv'd by them. For *Josephus Acosta*, a sober Writer, relates, That in certain *American* Mountains, Men, and the Beasts they ride on, sometimes are kill'd with the Winds, which yet preserve them from putrefaction, without any other help. So insensible a quantity of Matter, such as it may be, may, without Incision made into the body, both pervade it, and as it were Embalm it. I know also a very Experienc'd and sober Gentleman, who is much talkt of for curing of Cancers in Womens breasts, by the outward Application of an indolent Powder, some of which he also gave me, but I have not yet had the Opportunity to make Tryal of it. And I shall anon tell You, that I have seen a Liquor, which without being at all either acid or caustick, is in some bodies far more effectual against Putrefaction, than any of the corrosive Spirits of Nitre, Vitriol, Salt, &c. and than any of the other Saline Liquors that are yet in use. We have also tried a way of preserving Flesh with Musk, whose effects seem'd not despicable to us, but must not here be insisted on.

Instances of
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afterwards pre-
serv'd from pu-
trefaction only
by the wind.

Nor were it amisse that diligent Tryal were made what use might be made of Spirit of Wine, for the preservation of a humane Body. For this Liquor being very limpid, and not greasie, leaves a clear prospect of the Bodies immers'd in it; and though it doe not fret them, as Brine, and other sharp things, commonly imploy'd to preserve flesh, are wont to do, yet it hath a notable Balsamick faculty, and powerfully resists Putrefaction, not onely in living Bodies (in which, though but outwardly applied, it hath been found of late one of the potentest Remedies against Gangrenes) but also in dead ones. And I remember that I have sometimes preserv'd in it some very soft parts of a Body for many Moneths) and per-

Of the use of
Spirit of Wine
for the preser-
vation of Bo-
dies from pu-
trefaction,

haps I might had done it for divers Years, had I had opportunity) without finding that the consistence or shape was lost, much lesse, that they were either putrified or dried up: We have also, by mixing with it Spirit of Wine, very long preserved a good quantity of Blood, so sweet and fluid, that it was wondred at by those that saw the Experiment. Nay, we have for Curiosity sake, with this Spirit, preserved from further stinking a portion of Fish, so stale, that it shined very vividly in the dark; in which Experiment, we also aimed at discovering whether this resplendent quality of the decaying fish would be either cheished or impaired by the Spirit of Wine (whose Operations in this Trial we elsewhere inform You of) and it would be no very difficult matter for us to improve, by some easie way, this Balsamical Virtue of Spirit of Wine, in case You shall think it worth while. But not to anticipate what I may more properly mention to You elsewhere, I shall at present say no more touching the Conservation of Bodies, since probably by all these, and some other particulars, we may be induced to hope so well of Humane industry, as not to despair, that in time some such way of preserving the Bodies of Men, and other Animals, will be found out, as may very much Facilitate and advance too Anatomical knowledge. Neither is it onely by advancing This, that the Naturalist may promote the Physiological part of Physick: For since the Body consists not onely of firm and constant parts, as the Bones, Muscles, Heart, Liver, &c. but of fluid ones, as the Blood, Serum, Gall, and other Juices; And since consequently to the compleat knowledge of the use of all the parts we should investigate not onely the Structure of the Solid ones, but the Nature of the Fluid ones; the Naturalist may doe much more than hath yet been done, towards the perfecting of this Knowledge, not onely by better explicating what it is in general makes Bodies either Consistent or Fluid, but by
 examining

That the Examination of the Juices of humane body by the art of Chyrurgery may illustrate their Use & Nature.

examining particularly, and especially in a Pyrotechnical way, the nature of the several Juices of the Body, and by illustrating the Alterations that those Juices, and the Aliments they are made of, receive in the Stomach, Heart, Liver, Kidneyes, and other *Viscera*. For although a Humane body being the most admirable Corporeal piece of Workmanship of the Omniscient Architect, it is scarce to be hoped, but that even among the things that happen ordinarily and regularly in it, there will be many which we shall scarce be able to reach with our Understanding, much lesse to imitate with our Hands: Yet peradventure, if Chymical Experiments, and Mechanical Contrivances, were industriously and judiciously associated by a Naturalist profoundly skill'd in both, and would make it his business to explain the *Phænomena* of a Humane Body, not onely many more of them than at first one would think, might be made more intelligible than as yet they have been; but divers of them (especially those relating to the motions of the Limbs and Blood) might be by artificial Engines (consisting as the pattern not onely of Solid but Liquid and Spirituous parts) not ill represented to our very Senses: since a Humane Body it self seems to be but an Engine, wherein almost, if not more than almost, all the Actions common to Men with other Animals, are performed Mechanically. ~ But of the difference of these living Engines from others, I may elsewhere have a fitter opportunity to discourse to You. For at present, *Pyrophilus*, I have employed so much of the little time my Occasions will allow me to spend upon the Treatise I am now writing, in making out to You the Usefulness of Natural Philosophy to the Physiological part of Physick, that I must not onely not prosecute this Subject, but must both hasten to mention, and to mention the more cursorily its serviceableness to the four remaining parts of the Physicians Art.

That the Actions which are common to men with other Animals being performed Mechanically, the skill of Mechanicks must be of use to Physiology.



ESSAY II.

*Offering some Particulars relating to the
Pathological part of Physick.*

That the Naturalists knowledge may assist the Physician to discover the Nature and Causes of diseases.

AND to say something in the next place of *Pathology*, that the Naturalist's knowledge may assist the Physician to discover the nature and causes of several Diseases, may appear by the light of this Consideration, That though diverse *Paracelsians* (taught, as they tell us, by their Master) do but erroneously suppose that Man is so properly a Microcosme, that of all the sorts of Creatures, whereof the Macrocosm or Universe is made up, he really consists; yet certain is it that there are many Productions, Operations, and Changes of things, which being as well to be met with in the great, as in the little world, and diverse of them disclosing their natures more discernably in the former, than in the latter; the knowledge of the nature of those things as they are discoverable out of mans Body, may well be supposed capable of illustrating many things in man's body, which receiving some Modifications there from the nature of the Subject they belong to, passe under the notion of the Causes or the Symptoms of Diseases. It I were now, *Pyrophilus*, to discourse to you at large of this Subject, I think I could convince you of the truth of what I have proposed. And certainly, unlesse a Physician be (which yet I fear every one is not) so much a Naturalist, as to know how Heat and Cold, and Fluidity, and Compactness, and

and Fermentation, and Putrefaction, and Viscosity, and Coagulation, and Dissolution, and such like Qualities, are generated and destroyed in the generality of Bodies, he will be of ten very much to seek, when he is to investigate the causes of preternatural Accidents in mens Bodies, whereof a great many depend upon the Presence, or Change, or Vanishing of some or other of the enumerated Qualities, in some of the Fluid or Solid Substances that constitute the Body. And that the Explications of a skilful Naturalist may adde much to what has hitherto commonly been taught concerning the Nature and Origine of those Qualities in Physicians Schools, a little comparing of the vulgar Doctrine with those various *Phænomena*, to be met with among Natural things, that ought to be, and yet seem not to be, explicable by it, will easily manifest to You. And questionlesse tis a great advantage to have been taught by variety of Experiments in other Bodies, the differing wayes whereby Nature sometimes produces the same effects. For since we know very little *à priori*, the observation of many such Effects, manifesting, that nature doth actually produce them so and so, suggests to us several wayes of explicating the same *Phænomenon*, some of which we should perhaps never else have dream'd of. Which ought to be esteem'd no small advantage to the Physician; since he that knows but one or few of Natures wayes of working, and consequently is likely to ignore divers of those whereby the propos'd Disease (or Symptome of it) may be produc'd, must sometimes conclude, that precisely *such* or *such* a thing is the determinate Cause of it, and apply his method of relieving his Patient accordingly; which often proves very prejudicial to the poor Patient, who deerly payes for his Physicians not knowing, that the Quality that occasions the Distemper, may be as probably, if not more rationally, deduc'd from an other Origine, than from that which is presum'd. This will

scarce be doubted by him that knows how much more likely Explications than those applauded some Ages since, of divers things that happen as well within as without the body, have been given by later Naturalists, both Philosophers and Physicians: and how much the Theory of the Stone, and many other Diseases, that has been given us by those many Physicians, that would needs deduce all the *Phænomena* of Diseases from Heat, Cold, and other Elementary Qualities, is inferior to the Account given us of them by those ingenious Moderns, that have applied to the Advancement of Pathology, the Circulation of the Blood, the motion of the Chyle by the Milky vessels to the Heart, the consideration of the effects deducible from the Pores of greater Bodies, and the motion and figuration of their Minute parts, together with some of the more known Chymical Experiments: though both of those, and of the other helps mentioned just before them, I fear men have hitherto been far enough from making the best use, which I hope it will daily more and more appear they are capable of being put to. He that has not had the Curiosities to enquire out, and consider the several waies, whereby Stones may be generated out of the Body, not onely must be unable satisfactorily to explicate how they come to be produc'd in the Kidnies and in the Bladder, but will, perhaps, scarce keep himself from embracing such Errors, because authoriz'd by the suffrage of eminent Physicians, as the knowledge I am recommending would easily protect them from. For we find divers famous, and, otherwise, learned Doctors, who (probably because they had not taken notice of any other way of hardening a matter, once soft, into a stone-like consistence) have believ'd and taught that the Stone of the Kidneyes is produc'd there by slime baked by the heat and dryness of the Part; as a portion of soft Clay may, by external heat, be turn'd into a Brick or Tile. And accordingly they have

for

By particular
Instances of the
cause of the
Stone in the
Kidneys,

for cure, thought it sufficient to make use of store of Remedies to moisten and cool the Kidnies; which though, in some bodies this be very convenient, are yet far inferiour in efficacy to those Nobler medicines, that by Specifick qualities and properties are averse to such Coagulations as produce the Stone. But (not to mention what a Physician skill'd in Anatomy would object against this Theory from the Nature of the part affected) tis not unlike, the embracers of this Hypothesis would not have acquiesc'd in it, if they had seen those putrefactions out of the Bodies of Men, which we elsewhere mention'd. For those would have inform'd them, that a Liquor abounding with petrescent parts, may not onely turne Wood (as I have observed in a petrifying Spring) into a kind of Stone, and may give to Cheese and Mousse without spoiling their pristine Appearance a strong hardnesse and Weight; but may also produce large and finely shap'd Chrystalline Bodies (though those I tried were much lesse hard than Chrystal) in the bosom of the cold water. Which brings into my mind, that I have divers times produc'd a Body of an almost stony hardnesse in lesse than half an hour, even in the midst of the Water, by tying up in a rag about the quantity of a Nutmeg of well and recently calcined Alabaſter, which being thus tyed up and thrown into the bottom of a Bason full of Water, did there speedily harden into Lapideous Concretion. And that even in the bodies of Animals themselves such Concretions may be generated much otherwise than the Hypothesis we have been speaking of supposes, may appear by what happens to Craw-fishes, which though cold Animals, and living in the Waters, have generated at certain Seasons in their heads Concretions, which for their hard and pulverizable Consistence divers Authors called *lapides Cancrorum*, though in the Shops they are often but abusively styled *Oculi Cancrorum*. And such strong Concretions are affirm'd

The cause of
that disease il-
lustrated by the
putrefaction of
Wood, Cheese,
Moss, Water,
&c.

to be generated in these Fishes every Year, which I the leſſe ſcrupled at, becauſe I have not found them at all times in the Head of the Fiſh. And beſides, theſe and many more Concretions, that had they been obſerv'd by the Phyſicians we have been ſpeaking of, might eaſily have kept them from acquieſcing in, and maintaining their improbable explication of the manner of the Stones nativity. There is yet another kind of Coagulation, which may both be added to the former, and perhaps alſo may ſerve to recommend the uſe of Chymical Experiments, inveſtigating the Cauſes of Diſeaſes: This is made by the mixture of exquisitely dephlegm'd Spirit of fermented Humane Urine, with as exactly rectified Spirit of Wine; for upon the confuſion of thoſe two Volatile Liquors in a juſt proportion, they will both of them, as after *Lullius* Experience hath inform'd us, ſuddenly coagulate into a white Maſſe, which *Helmont* calls *Offa alba*, and by which he endeavours to declare the procreation of the Duelech: for ſuppoſing himſelf to have found in humane Urine a potential *Aqua vita*, or *Vinous* ſpirit, capable of being excited by a putrid ferment, and coagulable by the Volatile Salt of the ſame Urine, if there were any volatile Earth lurking in the Liquors; That being apprehended by the uniting Spirits, and coagulated with them both, he ſuppoſeth there may emerge from the union of thoſe three Bodies ſuch an anomalous Concretion, as he, after *Paracelſus*, calls *Duelech*.

And that a ſubtile Terreſtrious Subſtance may lurk undiſcerned even in limpid Liquors, may appear not onely in Wine, which rejects and faſtens to the ſides of the containing Veſſel, a Tartar, abounding in Terreſtrious Feculency; and in common Urine of healthy men, which, though clear at its firſt emission into the Urinal, does, after a little reſt there, let fall an *Hypoſtaſis*, or Sediment, which, if diſtill'd before fermentation, leaves in the bottom of the Cucurbite an Earthy Sub-

The Origine of
Helmonts alba
Offa, and *Paracelſus's Duelech*,
by the mixture
of Spirit of
Wine and Spirit
of Urine, an
example of the
Generation of
the Stone. *Helmont, de Lith. c.*
3 & 4.

Substance, and commonly some Gravel: but even in rectified Spirit of Urine it self I have had opportunity to observe, That after very long keeping, there hath spontaneously precipitated a Feculency, copious enough in proportion to the Liquor that afforded it. Nay, in another parcel of Spirit of Urine, that hath been kept much longer than that already mentioned, we observed the other day, that not onely there was a Terrestrial residence fallen to the bottom of the Glasse, but to the sides of it, as far as the Liquor reached, there adhered a great multitude of small Concretions; which, as far as appeared by looking on them through the Chrystal Viol, to whose insides they are fastened, were no other than little grains of Gravel, such as are often found sticking to the insides of Urinals, employed by Calculous persons.

That a terrestrial substance may lurk undiscerned in limpid Liquors.

To which we might adde an Experiment of ours, whereby we are wont almost in a moment, by barely mixing together a couple of Liquors, both of them distilled and transparent, and yet not both of them Saline, to thicken them very notably and permanently, insomuch that they seem not to precipitate each other; yet having once, for curiosity sake, distilled them with a pretty strong fire, I obtained a great quantity (as I remember, a fourth of the whole mixture) of a blackish Masse, that was not onely coagulated and dry, but even brittle: But of the coagulation of distilled Liquors, such as even Chymists themselves are not wont to look upon as at all disposed to coagulation, I may elsewhere have a better opportunity to entertain You, and therefore I shall forbear to do it now.

And by this way, *Pyrophilus*, doth *Helmont*, if I understand him aright, attempt to make out the generation of the Stone in humane Bodies: In which Theory, though some difficulties do yet keep me from acquiescing, yet besides that perhaps what You will meet with by and by (about the distillation of the *Duelech*) may make You the lesse wonder at this

explication. Besides this, I say, granting that none of the enumerated wayes of Petrescency (if I may so speak) deserve to be lookt upon as satisfactory, yet to give so much as an account *not very absurd*, of a Disease so anomalous and abstruse, and hitherto so unluckily explicated by Physicians, is perhaps more difficult, than it were to give (at least) a *plausible* account of divers other Distempers.

The use of
Chymistry in
explaining the
Nature of, and
aberrations in
our Digestions.

And possibly it may be safely enough affirmed, That not onely Physiology, in its full extent, but that Handmaid to it, which is called Chymistry, may not a little contribute to clear up the nature of both of the Digestions, and of those Deficiencies or aberrations in them, which produce a great part of Diseases; especially if we allow what, as well Physicians, as Spagyristes agree in, (whether warily enough or not, I shall not now dispute) *viz.* That whatever is separable from Bodies by the Fire, was, as a Constituent Element (or Principle,) pre-existent in them.

Perhaps I need not mind You, *Pyrophilus*, that tis usual with the meerly *Galenical* Doctors themselves, to explicate the nature of Catarrhes, by comparing the Stomach to a Seething pot, and the Head to an Alembick, where the ascending Vapors, being, by the Coldness of the Brain, condensed into a Liquor, sometimes distill upon the Lungs, and sometimes fall upon other weakned parts: in which Explication, though for diverse reasons I cannot acquiesce, yet it may suffice to shew You how little scruple many Learned men, not like to be partial in the Case, would make of employing Chymical Operations to illustrate the Doctrine of Diseases. And indeed, since the Liquors contained in the Body abound, diverse of them, with Saline or sulphureous parts, he that hath been by Chymistry taught the nature of the several sorts of Salts and Sulphurs, and both beheld and considered their various actions upon one another, and upon other Bodies, seems to
have

have a considerable help to discourse groundedly of the Changes and Operations of the humors, and other Juices contain'd in the Body, which he hath not, that hath never had *Vulcan* for his Instructor. He that finds that there may be acid Juices in the Stomach, and elsewhere, (as is frequently evident in the sharp Liquors which many Stomachs cast up) and that there are also Sulphureous salts in the Body (as is apparent in Blood and Urine, which abounds with such.) He that knows that the *Serum* that swims upon the Blood out of the Body, is by a gentle heat immediately coagulable into a thick whitish substance, not unlike a Custard, and that Chymically analyz'd Blood yields store of Volatile sulphureous, but (as far as our Tryals have hitherto inform'd us) no acid Saltneffe:

Proved by a
Catalogue of
considerable
Observations.

He that knows that these Animal Salts and Spirits may be so powerful, that we have been able with Spirit of Urine, or of Harts-horn, to make a red Solution of flowers of Sulphur, and that with spirit of Urine (though drawn without violence of Fire) we have (as we elsewhere more particularly declare) dissolved both in a very gentle heat, and in a very short time, the unopen'd body of crude Copper, so as to make thereof a Solution of a rich, deep, and even opacous Blew; and that we have done almost the like with unrectified Spirit of Man's Blood:

He that hath, as we have done, examined by Fire (especially produced by the help of a Burning-glasse) that limpid Liquor that is to be found in the Limphatick Vessels, and hath taken notice of that odde Consistence, Smell, Crackling, and other qualities discernable in it by heat.

He that observes how acid Liquors lose their Acidity, by working upon some Bodies; as when Spirit of Vineger grows almost insipid upon the Coral it hath corroded: and how those Saline Liquors, by working upon certain Bodies, degenerate into Salts of another nature, as we have sometimes observed

in Oyl of Vitriol, working upon the fourth part of its weight of Quick-silver, and how the contrariety of acid and sulphureous Salts makes them sometimes disarm, sometimes, after some ebullition, precipitate each other; and sometimes unite into a third substance, of a differing nature from either of those from whose coalition it results, as we see in *Tartarum Vitriolatum*; and, as I have observed, in a Salt, I sometimes make to emerge from a due proportion of Oyl of Vitriol and Spirit of Urine, freed, after conjunction, from their aqueous moisture: And He, in a word, that hath carefully analyzed and made trials on many parts, both of the Macrocosm and Microcosm, and heedfully applied his Experiments made on the former, to the illustration of the changes observable in the latter, shall be likely to explicate divers particulars in Pathology more intelligibly, than he that is a stranger to Chymistry.

That Salt and Sulphur have more influence in the causation of Diseases than the first Qualities are, Heat, Cold, &c.

And though I am very unwilling to meddle with Medical Controversies, and am apt to think, that Chymists are wont to speak somewhat too slightly of the humours of the humane Body, and allow them too little a share in the production of Diseases; yet (to skip other reasons) the strange stories related by *Skinkius*, and other Eminent Physicians, of the corrosivenesse of some Juices, which, rejected by Urine or Vomits, have been able to boile on Brasse, fret Linnen, and stain Silver; together with some odde Observations of this nature our selves have had opportunity to make, do very much incline us to believe, That the generality of former Physicians have ascrib'd too much to the Humours, under the notion of their being hot and dry, cold and moist, or endow'd with such other Elementary Qualities, and have taken a great deal too little notice of the Saline (if I may so speak) and Sulphureous Properties of things. And in this Opinion I am not a little confirmed by the Authority of *Hippocrates* himself, both in other passages, and especially where he sayes,

Non calidum, frigidum, humidum, aut siccum esse quod magnam agendi vim habet, verum amarum & salsum, & dulce & acidum, & insipidum, & acerbum, &c. are the things which, though inoffensive to the Body, whilst they duely allay each other, prove hurtful to it, and distemper it, when any of them comes to sever it self from the rest, and grow predominant. And indeed, if the Juices of the Body were more Chymically examin'd, especially by a Naturalist that knows the wayes of making fix'd bodies Volatile, and Volatile fix'd, and knows the power of the open Air in promoting the former of those Operations; it is not improbable, that both many things relating to the nature of the Humors, and to the wayes of sweetning, acuating, and otherwise altering them may be detected, and the importance of such Discoveries may be discern'd.

And perhaps it would adde to the usefulness of such an examination, if it were extended to the noxious Juices in distemper'd bodies: such as the rotten Phlegme spit up by those whose Lungs are disaffected; the slimy Excretions voided in the Lientery, and the liquor that distends the *abdomen* in the Dropsie and *Ascites*: concerning which (to tell You that upon the by) I found that it was of a differing nature from either Water or Urine. For a *Paracentesis* being made in the *Abdomen* of one dangerously sick of this sort of Dropsie, I found that the Liquor would keep a pretty while without putrefaction, (nor did the Patients Body, when I afterwards saw it opened, smell almost at all, though the inside of the *Abdomen* lookt well as neer as black as if it had been sphacelated;) and having steamed away some of it, whilst it was pretty fresh, over a somewhat slow fire, it first coagulated into a substance like Whites of Eggs, and, by a little farther Evaporation, turned to such a glutinous substance as Tradesmen are wont to call *Size*; and being kept longer on the fire grew to be hard

Observations made upon the Liquor that distends the *Abdomen* in the Dropsie,

Paracentesis.

like Fish-glew, but more brittle, and transparent enough, but with a little tincture of a greenish Yellow; and some of the forementioned Liquor being distilled in a Retort, did towards the end of the Operation so darken the Vessel with a thick blackish Oyl, as hindred me from discerning what else perhaps I might have seen. And I suppose it may prove a useful instance to the former purpose, if I somewhat circumstantially annex here what occurred to me, when I was accidentally considering of the *Calculus humanus*.

Observations
on the *Calculus
humanus*.

Having therefore obtained of a skilful Lithotomist of my Acquaintance divers Stones, which he had cut out of Mens Bladders, I chose a couple of them (which were whitish almost, of equal bignesse, and figure, which was neer Oval, and which together weighed about two Ounces and an half) these with the help of a strong Knife I carefully opened, to find whether or no either of them consisted of an entire and uniforme matter, (as most other Stones, and even some *Calculi humani* doe) and I found that each of them was made up of several Shells, as it were successively involving one another, like the rinds of an Onion. And such shells, but more soft, and more of a colour we likewise observed in a great Stone taken a while since out of an Oxes Gall, and sent us for a present; and though all of these were of an almost stony hardnesse, yet that hardnesse was not equal in them all; and in one of the Stones we observed one of the Rinds (to make use of that expression) to be of a differing Colour both from that which immediately embraced it, and from that which it immediately embraced: some of these Rinds equalled in thicknesse the length of a Barley-Corne, and others were somewhat thinner. Though they did closely embrace one another, yet they were actually separable, as well as visibly distinguishable. And proceeding very warily in the breaking one of these Stones, we found that in the Center of it there lay a small and soft oval
stone

stone, as it were the Kernel of those conglomerated Shells; and this Kernel lay so loose, that with a little industry and patience we picked it out of the Shell, and kept it by us as a rarity. This done, being desirous to know whither Chymical Tortures would force these Concretes to a farther Confession of their Nature, we caused them to be finely powdred, and put into a small but strongly coated Glasse-Retort, whereunto luring a much larger Retort for a Receiver, we found that these two Ounces and half of Powder, being distilled for some hours in a naked fire, afforded us great store of volatile Salt (partly grey and partly white) which almost covered the inside of the Receiver, and a pretty quantity of reddish Spirit, which in the Receiver it self soon coagulated into Salt, and having severed our Vessels, we found in the neck of the Receiver a very little darkish Oyl, but in the neck of the Retort a greater quantity of the same adust Oyl, incorporated with a pretty quantity of volatile Salt, whose smell did readily recall to my mind that peculiar kind of stink, which I had sometimes taken notice of in the volatile Salt of unfermented Urine; nor were the Tastes of these two Salts unlike. The *Caput mortuum* consisted of a fine, light, coal-black Powder, not unlike the finest sort of Soot; and by weighing but of six Drachmes, informed us, that above two thirds of the distilled *Calculi humani* had been, as being volatile, forced from the Terrestrial parts, even in a close Vessel, wherein the *Caput mortuum*, though it were left insipid enough, yet retained stink enough to make us think it still contained pretty store of heavy Oyl: as indeed, having put it into a Crucible, and kept it a competent while in a stronger fire, we found it reduced to about two Drachmes of a brittle Masse of insipid white Calx, which did not slack, or fall asunder like Lime when it is cast into the Water.

Of the changes
that may reason-
ably be
thought to hap-
pen to our Ali-
ments within
the Body.

To this Example of the usefulnesse of Chymistry, to discover the unobserved, and otherwise scarce discoverable difference of the *Calculus humanus* from other stones, we may venture to adde, That though some *Paracelsians* do take too much liberty, when they crudely tell us, that there are Arsenical, Vitriolare, Aluminous, and other Mineral substances, generated in humane bodies, yet if they had more warily proposed their Doctrine, it would not perhaps appear so absurd, as they are wont to think it, who considering onely the nature of the Aliments men usually feed upon, cannot conceive that such being but either Animals or Vegetables, can by so gentle a heat as that of man's Body, (by which they suppose all the changes of the Aliments must be effected,) be Exalted to an energie like that of such bodies as are composed of active Mineral substances, and have some of them perchance acquir'd a violence of operation from the fire. But we see that Concretions, so like Stones, (which belong to the Mineral Kingdom,) as to passe generally for such, may be produc'd in the bodies not onely of men but of sucking Children, whose Aliment is fluid Milk: and it seems a mistake to imagine (how many soever do so) that heat must needs be Efficient of all the Changes the matter of our Aliments may happen to undergoe in a humane Body; where there are Streiners, and Solvents, and new mixtions, and perhaps Ferments, and diverse other powerful Agents, which by successively working upon the assumed Matter, may so fashion and qualifie it, as, in some cases, to bring the more disposed part of it to be not unlike even fossile Salts, or other Mineral substances. A very eminent person was lately complaining to me, that in the fits of a Distemper, which almost as much puzzels her Physicians as her self, she sometimes vomits up something so sharp and fretting, that, after it hath burnt her throat in its passage, almost like scalding Water, it doth not onely stain the Silver-vessels that received it,

it, but also worke upon them as if it were a Corrosive Menstruum. And there dyed a while since a very intelligent person, much employed in publick affaires, who complained to me, that in the fits of the strange distemper he laboured under, he divers times observed, that, that part of his pillow which his breath passed along, would by the strange fuliginous Steames, which that carried off with it, be blackt over, as if it had been held in some sooty smoak or other.

We may also consider, that the Rain-water, which in its passage through a Vine, or an Apricock-tree, or the like plants is turned into a sweet fruit in its passage through those plants that bear Lemmons and Barberries, is transmuted into a liquor sharp enough to corrode, not only Pearles but Coral, *lapides cancerorum*, and other hard Concretes. as Spirit of Vitriol would do. And writes of unsuspected credit, affirme, that an *Indian* fruit, (whose name I cannot readily call to mind) will speedily corrode and waste the very Steele knives 'tis cut with, if its Juice be left long upon them: and we see that some sorts even of our Apples and Pears, will quickly blacke the blades of Knives on which the Juice is suffered to continue. And lest what I freshly mention'd about Lemmon-trees, should be question'd, I will here adde, that I remember also that I have made not only some other hot and strongly tasted Herbs, but even a *Ranunculus* it self, to grow and increase notably in wight as well as bulke, though I fed it but with faire water: and allowed it nothing else to shoot its root into. Wherefore since this Plant is reckon'd amongst those that either are poysonous, or want but little of being so; and since its operation is so violent, that this sort of Vegetables, is taken notice of from the experience of Country people, to be able by outward application to draw blisters, and since nevertheless that which this Plant, without any heat discernable by the touch, transmutes into so virulent a substance, is but so un-

Illustrated by
the example of
Juices out of
the body.

Give a body as water, why may not such aliments, as may have in them divers parts of a far more operative nature, be in a humane body, by an unusual concurrence of Causes and Circumstances, so altered and exalted, as to approach in operations (especially upon the more tender parts) to those of fossile Salts or other Minerals? So that a Chymist might upon such an account, without any great absurdity, teach some parcels of Morbifick matter to be of an Arsenical, or Vitriolate, or an Antimonial nature, especially since we see that sometimes Cancers, Ulcers, and sharp Juices generated in the body, do by their vitiating and wasting the invaded parts, but too much emulate the pernicious operations of Arsenick, and of fretting Salts: and the infusion of Antimony doth scarce more stimulate nature to disburthen her self both upwards and downwards, than doth sometimes an humour, such as that which causes the *Cholera morbus*, and perhaps more violent diseases.

And that such degenerations of Innocent aliments should sometimes happen in discomposed bodies, you will perhaps think the less strange, if you duly perpend what I lately mention'd of the transmutation of Water into hot and vesicatory substances; and if thereto I annex, that from a single pound of so common and temperate an Aliment as Bread, I can by an easie way, (and that without addition) obtain many ounces of a *menstruum*, which (as tryal has inform'd) will work more powerfully upon bodies more compact than some hard minerals, or perhaps Glass it self, than a wary Chymist would expect to see *Aqua fortis* do. These things I have mention'd, *Phyrophilus*, to intimate some of the Reasons, why I think Chymical Experiments may be usefully apply'd, to illustrate some things in Pathologie, either by imitating out of the body, the productions of some sorts of morbidick matter, or by such resolutions as that which is generated in the body, as may conduce to the discovery of its nature. And not that

I think, as Spagyrist do, the experiments or notions of vulgar Chymists sufficient to explicate the whole doctrine either of Digestion or of Diseases: for it would be very difficult for them to make out the manner of Nutrition, or so much as how they that feed only on Vegetables, should (to propose the difficulty in their own Terms) have their Blood and Urine copiously enrich'd with a Volatile sulphureous Salt, of which sort, plants are not wont to yield any in distillation. And much more difficult would it be for them by principles peculiar to Chymists to make out the propagation of Hereditary diseases: or how madness, & some other distempers, that do not visibly vitiate the organs of those functions that they pervert, should not only prove hereditary, but lurk very many years in the inheriting persons body, before they begin to disclose themselves: and sometimes too, be transmitted from the Grandfather to the Grand-child, and skip immediately the intervening Son. And therefore I say again, that I pretend not that Vulgar Chymistry will enable a Physician to explicate all or most of the Pathological *Phænomena*; but that True Chymistry may assist him to explicate divers of them, which can scarce be solidly explicated without it. And let me adde, that he that thoroughly understands the nature of Ferments, and Fermentations, shall probably be much better able then he that ignores them, to give a fair account of divers *Phænomena* of several diseases (as well Feavers as others) which will perhaps be never thoroughly understood, without an insight into the doctrine of Fermentation; in order to which, for that and other reasons, I design'd my Historical notes touching that subject.

Yet I am not sure, but there may be effervescences, (and perhaps periodical ones) in the Blood and other Juices of the body without Fermentation properly so call'd. For there may be divers other wayes of begetting a præternatural heat

Difference between Vulgar and true Chymistry

The Use of the Knowledge of Fermentation.

Of Periodical effervescences in the blood without Fermentation.

in the Blood. We often see that in Coughs, when the flegme is rotten (as they speak) that is, when its former viscus texture is altered, it does no longer stick fast to the vessels of the Lungs, to which it obstinately adher'd before. And so at certain times other humours in the body, either by growing more fluid themselves, or by some change in the Blood, whereby it becomes fitter to dissolve such humours, may swimme in, and be circulated with the mass of blood, and thereby occasion præternatural heats: *either* by their indisposition to be well incorporated therewith: *or* by altering its texture: *or* disturbing the wonted motion of its minute parts: *or* by opposing its due Rarefaction as it passeth through the Heart: *or* by obstructing the more slender Vessels, and so hindering the free Circulation of the Blood through them; perhaps also causing some Extravasation, as we see that wounds & bruises are attended with some inflammation, more or less, of the part affected; or by some other of the wayes not now to be declared. And tryal hath taught me, that there are Liquors, in which the bare admixture of Milk, Oyl, or other Liquors, my or of cold water, will presently occasion a notable heat: and I sometimes employ a *menstruum*, in which nothing but a little flesh being put, though no visible Ebullition ensue, there will in a few minutes, be excited a Heat intense enough to be troublesome to him that holds the Glass. And yet it seems not necessary that this should be ascrib'd to a true fermentation, which may rather proceed from the perturb'd motion of the Corpuscles of the menstruum, which being by the adventitious liquor or other body put out of their wonted motion, and into an inordinate one, there is produc'd in the menstruum a brisk confus'd Agitation of the small parts that compose it; and in such an agitation (from what cause soever it proceeds) the nature of Heat seemes mainly to consist. But to dispatch, I scarce doubt, but that if in the history of diseases, there were better notice

notice taken of those *Phænomena*, that agree not with the opinions already in request, as well as of those that are thought consonant to them; and if also Chymical tryals were skilfully varied and judiciously applyed to this illustrating of Pathological *Phænomena*, the former might be made conducing to the better-explication of the latter: especially if the business were manag'd by a Naturalist well versed both in Chymical Experiments, and in Anatomy, and the history of Diseases, without being too much addicted either to the Chymist's notions, or the receiv'd opinions of Physicians.

And as the Naturalist may thus illustrate Pathology as a Chymist, so may he do the like as a Zoologer, for either the true knowledg^e of Anatomy must be much less useful to Physicians that they have hitherto believed, or else the discoveries made by recent Anatomists of the *Afellian*, *Pecquetian*, and *Bartholinian* vessels, by either overthrowing the receiv'd doctrine of Digestions, (from whose aberrations many diseases spring) or at least by making divers discoveries in relation to the Oeconomy of Digestions unknown to the Ancients, must probably contribute much to the clearing up of divers Pathological difficulties in the explication of some diseases; besides, that the very liberty of making those Experiments in live Beasts, which are not to be made but in living creatures, nor are allowable to be made in living men, may enable a Zoologist, by giving us a clearer account of divers parts of the body, to determine divers Pathologicall difficulties springing from either our ignorance or mistakes of the use of those parts, as by the formerly mention'd Experiment of the excision of a live dog's Spleen, and a watchfull observation of all the diseases upon that Account, befalling him and other dogs so serv'd; much light perhaps may be given to the doctrine of the use of the Spleen, together with the diseases supposed to depend upon that part, which I fear is hitherto (to the no

Of the Use of
Zoology to
the knowledge
of diseases.

small prejudice of the Sick) by few Physicians thoroughly understood, and by many unhappily enough mistaken.

And here we may represent unto you, *Pyr.* that not only the dissections of sound Beasts may assist the Physician to discover the like parts of a humane body, but the dissections of morbid beasts may sometimes illustrate the doctrine of the causes and seats of diseases. For that this part of Pathology has been very much improved by the diligence of modern Physicians, by dissecting the bodies of men kill'd by Diseases, we might be justly accused of want of curiosity, or gratitude, if we did not thankfully acknowledge; For indeed much of that improvement of Physick, (for which the Antients, they were not alive, might envy our new Physicians) may, in my poor opinion, be ascribed to their industrious scrutiny of the Seat and Effects of the peccant matter of Diseases in the bodies of those that have been destroyed by them.

And that the instructions deducible from such observations may be either increased or illustrated by the like observations made in the bodies of Beasts, we have been inclin'd to think, partly by the having Chymically analyz'd (as they phrase it) the Blood of divers Brutes, as Sheep, Deer, &c. and found in Phlegme, Spirit, Salt, and Oyl, very like that of humane blood; and partly by our having observ'd in the bodies of several Brutes, (not excepting Fishes) Worms, Impostures, and the like, some of which seem'd manifestly to spring from such causes as are wont to produce resembling distempers in men: And if the acute *Helmont* had been a more diligent dissector of Beasts, he would perchance have escaped the Error he after others run into (and into which his Authority hath tempted others to run) when he affirm'd, that the Stone was a disease peculiar to men, for that in the bodies of Beasts, especially very Old ones, Stones are sometimes to be found, not only several Butchers have assured me, but you may gather partly

Helmonts error refuted, that the Stone is a disease peculiar to Man.

partly from that taken out of an Oxes Gall, which I have formerly mention'd, which was about the bigness of a Wall-nut) but principally from what I Elsewhere deliver'd on purpose to disprove that fond assertion: and greater leisure may, upon another occasion, invite us to mention some Pathological Observations made in diseased Beasts, by which (were we not willing to hasten) we might now perhaps much confirm what we have propos'd touching the possibility of illustrating, by such Observations, the nature of some of the Diseases incident to humane bodies,

And here we may also consider that there are divers Explications of particular Diseases, or troublesome Accidents propos'd by Physicians, especially since the Discovery of the Bloods Circulation, wherein the Compression, Obstruction, or Irritation of some Nerve, or the Distension of some Veine by too much Blood, or some Hinderance of the free Passage of the Blood through this or that particular Vessel, is assign'd for the cause of this or that Disease or Symptome, Now in divers of these cases the Liberty lately mention'd, that a skilful Dissector may take in Beasts, to open the Body or Limbs, to make Ligatures strong or weak on the vessels, or other inward parts, as occasion shall require, to leave them there as long as he pleaseth, to prick, or apply sharp liquors to any nervous or membranous part, and whenever he thinks convenient, to dissect the Animal again, to observe what change his Experiment hath produc'd there: such a Liberty I say, which is not to be taken in humane bodies, may in some case either confirm or confute the Theories propos'd, and so put an end to divers Pathological Controversies, and perhaps too occasion the Discovery of the true and genuine causes of the *Phænomena* disputed of, or of others really as absurd.

To this let me adde, that there is a whole *classis* of diseases to

to be met with in Physicians Bookes, which proceed not originally from any internall distemper of the Patient, but are produced by some exterior Poyson, and are therefore wont to be call'd by Doctors, *Morbi à veneno orti*, to the more accurate knowledge of divers of which Diseases, Experiments made on Brutes may not a little conduce: For though I deny not that some things may be Poysons to Man, that are not so to some Beasts; and on the contrary (as we have more than once given to a Dog, without much harming him, such a quantity of *Opium*, as would probably have suffic'd to have kill'd severall Men) yet the greater number of Poysons being such both to Man and brutes, the liberty of exhibiting them, when, and in what manner we please, to these (which we dare not do to him) allowes us great opportunities of observing their manner of operation and investigating their Nature as our selves have tryed, and that sometimes with unexpected events (as when lately a Cat ran mad, so that her Keeper was fain to kill her) upon a large dose of *Opium* which we caused to be given her.

And on this occasion I shall not scruple to transcribe an Observation out of a Discourse, I some yeares since writ to a Friend, about the turning Poysons into Medicines, because that Treatise I am like, for certain reasons, to suppress: The words, as I there find them, are these.

That the Venom of Vipers or Adders consists chiefly in the rage and fury wherewith they bite, and not in any part of the body that hath at all times a mortall property.

Before I take leave of Vipers (or Adders, as some will have those that here in England commonly passe for Vipers) it will not be impertinent to tell you, That it may be justly doubted; whether they be to be reckon'd amongst poisonous Creatures, in such a sense as those other venomous Creatures, who have in them a constant, and if I may so speake, grosse and tangible Poyson; for it may be supposed, that the venom of Vipers consists chiefly in the rage and fury wherewith they bite, and not in any part of the Body, which hath at all times a mortall property. Thus the

madnes of a Dog makes his teeth poysonous, which before were not so. And Authors of good repuse supply us with Instances of hurts, in themselves free from danger, that have been made fatal by a Venom created by the fiercenes of the enraged (though not otherwise poysonous) Creatures that inflicted them. And Baccius, if I mistake not, in his Treatise de Venenis, tels us a memorable Story (whereof he affirms himself to have been an Eye-witnes) of a Man who was killed within three days, by a slight hurt received in his left hand, from an enraged Dunghil-Cock; and that no parts of the Viper have any constant inherent poyson in them, I have been induced to suspect upon this Experiment, That dissecting some live Vipers, there came in accidentally a strang Dog, to whom I gave the Head, Tail, and Gall, (which are the parts supposed to contain the poyson) of one of them, & the head and gall of another, wrapt up in meat; after which I locked the little dog up in my own Chamber, & watched him; but found not that he was sick, or offered to vomit at all, but only lapped up greedily some drink which he espyed in the Room; nor was he alone very jocund, for divers hours that I kept him in, but liked his entertainment so well, that he would afterwards, when he met me in the street, leave those that kept him to fawn on and follow me. And having since related this Experiment to an inquisitive friend of mine, he assured me, That to satisfie himself further in this particular, he gave to a Dog a dozen heads and galls of Vipers, without finding them to produce in him any mischievous symptom. To which I shall add, That the old Man you know, that makes Vipe-Wine, does it (as himself tels me) by leaving the whole Vipers, if they be not very great, perhaps for some months, without taking out the Galls, or separating any other part from them in the Wine, till it hath dissolved as much of it as it can.

And though it may seem somewhat improper, whilst we are discoursing of Poysons, to insist on a remedy against them; yet the mention of Vipers recalling into my mind a memorable Ex-

A certain Cure
for the biting of
Vipers.

Experiment which I tryed against the biting of Vipers, I shall choose rather to decline the dictates of Method, than those of Charity, which forbids me to suppress a remedy that may possibly rescue from sudden death, a person or other fit to live, or unprepared to dye; because it does not strictly belong to the Theme whereto it is referred. The remedy then is this, that as soon as ever a man is bitten (for if the Poyson have had time enough to diffuse it self, and gain the Mass of Blood, I doubt the Experiment will scarce succeed) a hot Iron be held as neer the place as the Patient can possibly endure, till it have, as they speak, drawn out all the Venom: which Eye-witnesses assure me (for I have not yet seen that my self) will sometimes adhere like a yellowish spot to the surface of the Iron. But being upon competent grounds satisfied of the Experiment, to convince a Physician that mistrusted it, I last Summer hired a Man (who doubted it as little as I) to suffer himself to be bitten by a Viper; and having in the Physicians house and presence picked out of a good number of them one of the blackest I could find (those of that colour being supposed the most mischievous) and commanded the fellow to provoke and anger it, (which to my wonder he did, a pretty while before the beast would fasten on him.) At length being by his very rude handling thoroughly exasperated, it bit him with great fury, as it seemed; for immediately his hand began to swell, and the injured part was grown tumid, before we could take from the fire, which was hard by, a Knife that lay heating there; and having applied it as near as he could suffer it, for about ten or twelve minutes, we found that the swelling, though it decreased not, did not spread, and the Man glad of his Money, without farther Ceremony, went about his affairs, and told me since, That though the Tumor continued a while, he had no other inconvenience attending it, and hath divers times got money by repeating the Experiment, though otherwise, by the casual bitings of Vipers, he hath been much distressed, and his Wife almost killed.

But,

But, *Pyrophilus*, to return to the Experiments of Poysons made on Beasts, we could wish Physicians were more diligent to make Tryals of them, not onely by giving Beasts Poysons at the mouth, but also by making external applications of them, especially in those parts where the Vessels that convey Blood, more approach the surface of the Body, and also by dexterously wounding determinate Veins with Instruments dipt in Poysons (especially moist or liquid ones) that being carried by the circulated Blood to the Heart and Heat, it may be found whether their strength be that way more uninfringed, and their operation more speedy (or otherwise differing) than if they were taken in at the mouth. For I remember sober Travellers have shewed me some *Indian* Poysons, whose noxious efficacy they affirmed to be by great intervals of time, differingly mortal, according as the slight hurt made by the points of Arrows, infected with them, did open a capillary or larger Vein, and were inflicted on a part more or lesse distant from the Heart; but having not yet made any tryal of this myself, I dare not build upon it. Yet I find that the formerly commended *Olearius*, in his travels into *Muscovie* and *Persia*, takes notice of a venomous Insect in *Persia*, which the Natives call *Encureck*, and which he (how justly I know not) makes to be a kind of *Tarantula*, because it is, as that Creature, in shape almost like a Spider, and speckled, though of twice the bignesse of a Thumb: This Insect (sayes he) instead of stinging or biting, lets his Venom fall in form of a drop of Water, which immediately produces insufferable pains in the part to which it fastens, and suddenly penetrating as far as to the Stomach, sends up Vapors to the Head, which sends again (to use his expression) so profound a sleep to all the Patients limbs, that it is impossible to awaken him, but by one onely Remedy, which is to crush one of these Creatures upon the

Of external application of Poysons, and letting them into the Veins of Beasts.

Voyage de Moscovie & de Perse, pag. 334.

hurt, whence he abstracts all the Poyson. Some horrid and unual symptomes of this venom, which yet agree not so well with those that are wont to be produced in persons bitten by *Tarantula's*, our Author proceeds to mention, and furnishes us with a proof of what we were lately saying, when we told you that some things were poysonous to men, which were not to some Beasts; by adding, as an admirable singularity, that the Sheep of those parts do not onely eat these fatal Insects, but seek for them. I know also, by sad experience in my self, what an outward application even of *Cantharides* can do; for having occasion to have a large blister drawn on my neck, the Chirurgeon I employed, unknown to me, made use of *Cantharides*, among other Ingredients of his vesicating Plaister, with a few hours after I had taken it, waken'd me with excessive torment, to which it put me about the neck of my bladder, so that I apprehended it might proceed from some Stone unable to get out; of which sudden and sensible pain, after I had a while in vain conjectured what might be the cause, I at length suspected that which was indeed the true one; and having sent for the Chirurgeon, he confessed to me, upon my demand, that he had put some *Cantharides* in his Plaister, not thinking it would have had such an operation: whereupon I soon reliev'd my self, by drinking new Milk very well sweetned with Sugar-Candy.

POSTSCRIPT.

TO enable You, *Pyrophilus*, to gratifie those inquisitive persons that have heard some, and yet but an imperfect Report, of a much noised Experiment, that was some Years ago devised at *Oxford*, and since tried in other places before very Illustrious Spectators; I am content to take the occasion afforded me, by what was in the foregoing Essay lately mentioned

tion'd concerning the application of Poysons, to inform you, That a pretty while after the writing of that Essay, I hap- pen'd to have some Discourse about matters of the like na- ture, with those excellent Mathematicians, Dr. *J. Wilkins*, and Mr. *Chrystopher Wren*; at which the latter of those *Virtu- osi* told us, That he thought he could easily contrive a way to convey any liquid poyson immediately into the Masse of Blood. Whereupon our knowledge of his extraordinary Sagacity, making us very desirous to try what he propos'd, I provided a large Dog, on which he made his Experiment in the presence, and with the assistance of some Eminent Phy- sicians, and other Learned men. His way (which is much better learned by sight than relation) was briefly this: First, to make a small and opportune Incision over that part of the hind-leg, where the larger Vessels that carry the Blood, are most easie to be taken hold of: Then to make a Ligature up- thole Vessels, and to apply a certain small Plate of Brasse (of above half an Inch long, and about a quarter of an Inch broad, whose side were bending inwards) almost of the shape and bignesse of the Naile of a Man's Thumb, but somewhat longer. This plate had four little holes in the sides, near the corners, that, by threads pass'd through them, it might be well fastned to the Vessel. And in the same little plate there was also left an Aperture, or somewhat large Slit, parallel to the sides of it, and almost as long as the plate, that the Vein might be there expos'd to the Lancet, and kept from starting aside. This plate being well fastened on, he made a slit along the Vein, from the Ligature towards the heart, great enough to put in at it the slender pipe of a Syring, by which I had propos'd to have inject'd a warm solution of *Opium* in Sack, that the effect of our Experiment might be the more quick and manifest. And accordingly our dexterous Experimenter having surmounted the difficulties which the tortured Dogs violent

Experiments of
conveying li-
quid poysons
immediately in-
to the Mass of
Blood.

violent struglings interposed, conveyed a small Dose of the Solution or Tincture into the opened Vessel, whereby, getting into the Masse of Blood (some quantity of which, tis hard to avoid shedding in the operation) it was quickly, by the circular motion of That, carried to the Brain, and other parts of the Body. So that we had scarce untied the Dog (whose four feet it had been requisite to fasten very strongly to the four Corners of the Table) before the *Opium* began to disclose its Narcotick Quality; and almost as soon as he was upon his feet, he began to nod with his Head, and faulter and reel in his pace, and presently after appeared so stupified, that there were Wagers offered his life could not be saved. But I that was willing to reserve him for further observation, caused him to be whipped up and down the Neighbouring Garden, whereby being kept awake and in motion, after some time he began to come to himself again; and being led home, and carefully tended, he not onely recovered, but began to grow fat so manifestly, that twas admired: But I could not long observe how it fared with him. For this Experiment, and some other tryals I made upon him, having made him famous, he was soon after stoln away from me. Succeeding attempts informed us, that the Plate was not necessary, if the finger were skilfully employed to support the Vessel to be opened; and that a slender Quill, fastned to a Bladder, containing the matter to be injected, was somewhat more convenient than a Syringe; as also that this notwithstanding, unlesse the Dog were pretty big, and lean, that the Vessels might be large enough & easily accessible, the Experiment would not easily succeed. The Inventor of it afterwards practiced it in the presence of that most Learned Noble man, the Marquess of Dorchester, and found that a moderate Dose of the Infusion of *Crocus Metallorum* did not much move the Dog to whom it was given: but once that he injected a large Dose (about two Ounces

Ounces or more) it wrought so soon, and so violently upon a fresh one, that within a few hours after, he vomited up life and all, upon the Straw whereon they had laid him. I afterwards wished, that not onely some vehemently working Drugs, but their appropriated Antidotes or else powerful liquid Cordials) and also some altering Medicines might be in a plentiful Dose injected. And in Diureticks a very ingenious Anatomist and Physician told me, he tryed it with very good success. I likewise proposed, That if it could be done, without either too much danger or cruelty, tryal might be made upon some humane bodies, especially those of Malefactors. And some Moneths after, a forreign Ambassador, a curious person, at that time residing in *London*, did me the honour to visit me, and inform'd me, That he had caus'd tryal to be made with infusion of *Crocus Metallorum*, upon an inferior Domestick of his that deserv'd to have been hang'd; but that the fellow, as soon as ever the Injection began to be made, did (either really or craftily) fall into a Swoon, whereby being unwilling to prosecute so hazardous an Experiment, they desisted, without seeing any other Effect of it, save that it was told the Ambassador, that it wrought once downward with him, which yet might, perhaps, be occasioned for fear or anguish: But the tryals of a very dexterous Physician of my acquaintance in humane Bodies will perhaps, when I shall have received a more circumstantial account of them, be not unwelcome to You. And in Dogs, you may possibly from our own Observations, receive a further Account of an Experiment, of which I now chiefly designed but to relate to you the Rise and first Attempts.



ESSAY III.

*Containing some Particulars relating to the
Semeiotical part of Physick.*

That the improvement of the *Therapeutical* would alter the prognosticks in the Semeiotical part of Physick.

THe Semeiotical part of the Physician's art, seems capable of the least improvement by Natural Philosophy. In which yet, *first* the Naturalist may, by illustrating the Anatomical and Pathological parts, assist the Physician to make more certain conjectures from the signs he discovers of the constitution and distempers of his Patient. For You will easily believe that, *ceteris paribus*, he that better knows the nature of the parts and juices of the Body, will be better able to conjecture at the events of Diseases, than he that is lesse skilled in them. And *secondly*, The Naturalist by improving the *Therapeutical*, may at least, much change and alter the Prognosticks of the duration, ferocity, and event of Diseases. For, *Pyrophilus*, it would be considered, that the Predictions hitherto current in Authors, and commonly made by Physicians, suppose the use of the received Remedies, and the dogmatical method of Physick; but if there were discovered such generous and commanding Medicines, as, by powerfully assisting Nature, or nimbly proscribing the Morbifick Matter that doth either produce or (though produc'd by them) cherish Sickneses, might enable Nature to hinder the Disease from continuing its course, and acting almost all the
Scenes

Scenes of its Tragedy in the Body; Physicians need not in acute Diseases wait so often for a *Crisis* to instruct their Prognosticks; and the threatening Symptomes of Chronical Distempers would often prove false Prophets.

To illustrate this but with a not ignoble instance, give me leave to tell You, That when that *Peruvian* Bark, that now begins to be somewhat taken notice of, under the name of the *Jesuits Powder*, had scarce been so much as heard of in this part of *Europe*, I went to visit a *Virtuoso*, who had been for some Moneths afflicted with a *Quartan* Ague, so violent and stubborn, that it had frustrated the skill, and almost tired the endeavours of the most eminent Doctors of this Nation; of one of which, who was then accidentally with his Learned patient, I enquired how my Friend did, and was answered, That he hoped he would recover when the Season would give him leave; but in the Winter he knew no *Quartans* cured. Yet the Gentleman acquainting me with his having procured some of the *American* Bark against Agues, which we mentioned in a former Essay, and I (after having tasted and considered it) having encouraged him, as I have others, to make Tryal of it, as the strange Effects I have observ'd of it hath divers times invited me to do; the Candid and learned Doctor, not onely opposed not my persuasions, but added his own to them. And my Friend taking two Doses of this Powdered Bark, though it were at the unhopeful Season of the Year (the Winter Solstice) and though he scarce found any sensible operation (unlesse a litle by Sweat) of the *Peruvian* Medicine, had by the first Dose his Fit very much lessen'd, and by the second quite removed. And though through some irregularities of Diet (to which that keen Appetite, like that of recovering persons, which I have observ'd this Powder to be wont to produce, tempted him) he did, as I then foretold him he would, after missing eight or ten Fits, relapse; yet by the

An instance to that purpose in the *Peruvian* Bark.

repeated use of the same Remedy, he again recovered, and hath continued so ever since. Having also lately perswaded the use of the same Medicine, in the same Disease, to one of the greatest Ladies in this Nation, she told me the other day, That it immediately, and in unlikely weather, freed her from those Fits, from whence she dispaired to be delivered till the Spring. Having likewise sent some of it to a couple of Gentlemen, sick of the like Malady, I had word brought me That one had missed his Fits for a Moneth, though in the midst of Winter; and the other was by the first Dose cured, and continues so. And divers eminent Physitians, to whom I have commended the Specifick, have used it with such success, that one of the severest of them, though he had formerly dispised it, confessed to me, that in a short time he tried it upon eight or nine several persons, without finding it to fail in any, though one of them especially were, before he was called, judged irrecoverable; the obstinate Quartan being complicated with other almost as dangerous Distempers. And I confess I somewhat wonder that men have not the Curiosity to try the efficacy of this powerful Birk in other Diseases than Agues; it being highly probable, That a Medicine, capable to prevaile so strongly against so obstinate a Disease as a Quartan, (wherein most commonly divers of the considerable parts of the Body are much affected) cannot be uselesse to several other Distempers. I deny not that those that have taken this Powder, have divers of them, after having missed six or seven Fits, relapsed into them, (as it likewise happened to one of the Gentlemen I sent it to) yet (as I have elsewhere told You) it is much, and more than any common Remedy does, to stop the Fit so long. Not is it a small matter to be able to give the Patient so much breathing time, and allow the Physician the opportunity of imploying other Remedies. And the Relapses we speak of are commonly cured
by

by the same Powder: and we have known them prevented, when the Medicine hath been administred, not by unskilfull persons, but by a prudent Physician, who knows how to assist it, by opening and gently purging Physick. Wherefore that which I should be most gladly satisfied of about this Remedy, is, whether or no it do indeed either proscribe the morbidick Matter, or so alter its Texture as to make it harmlesse; or else, whether it doth secretly leave such noxious Impressions upon the Spleen, Guts, or some other important part, as may shorten Life, by producing in proesse of time, either the Scurvy, or the Dropfie, or some other formidable Disease. But because the Resolution of this Doubt must be a work of time, we must at present refer it to future Observation; and therefore shall now subjoyn, that if the famous *Riverius* have not, in his learned Observations, flattered his own *Febrifugum*, whatever he resolved touching this *Indian* Bark, there will not want a safe Remedy which may allow Physicians to make more cheerful predictions about the last-inges and event of Quartans, than have hitherto been usual.

And in *Riverius's febrifugum*, and a new cure of the Kings Evill.

Riverius in Observation.

How painful and stubborn a Disease the Kings evill is wont to prove, is scarce more known, than that tis seldom cured without a tedious course of Physick: And yet by the Herb mention'd in one of the former Essayes, the young Gentleman there spoken of, was cured in a short time, and with little or no pain or trouble. And that these are not the only Diseases in which Observations, tending to our present purpose, may be made, the following part of this Treatise will afford You opportunity to observe.

* *Vide infra c. 2. p. 204.*

I might adde, *Pyrophilus*, that I was lately visited by an ancient Chymist, enobled by divers eminent Cures, who promiseth to me an Experiment of making very unusual, and yet rational Predictions in some abstruse Diseases, by a peculiar way of examining the Patients Urine. But because some

Chymists have written extravagantly enough upon a like Subject; and because I have not yet made or seen the Experiment of it my self, I dare not yet give this new method of foretelling, for an instance of the Usefulness of Natural Philosophy to the Semeiotical part of Physick. Though I dare not deny but by Precipitations, and some other wayes not yet vulgarly practiced of examining the Urine, made by the same Patient at several times, before, in, and after some notable alteration in his Body, divers things (especially in Fevers, and other acute Diseases) relating to the state of it, may be discovered, especially if thereto be added a skilful and Seasonable Chymical *Examen* of the other Excrements, and vitiated Substances of the Patients body.

That though no Disease should be incurable, yet every Disease is not curable in every Patient.

You will perchance expect, *Pyrophilus*, that on this occasion I should handle that controversie which is so hotly agitated betwixt the *Paracelsians* and their adversaries, concerning the Curableness of all Diseases: but for ought I can perceive, the difference betwixt the more sober men of both parties, is more about Words than Things, and might be reduced to a much lesse distance, if men could but calmly consider, That tis one thing to dispute, *Whether all Diseases be curable*, and another, *Whether all Persons be recoverable*? For a Disease may be called incurable, either in its own nature, or by accident; that is, either because such a Disease is not to be cur'd in any Patient, or that it is so circumstantiated in this or that Patient, as not to be naturally curable in him. Now this distinctly & duly considered, may conduce much to reconcile the two Opinions, if not the parties that maintain them: For neither would a sober *Paracelsian* affirm, (though *Paracelsus* himself doth somewhere seem to do so,) That every Disease is curable in every Patient; there being some Palsies, Gouts, or Blindnesses, or the like, so obstinate, that, especially if they are born with a Man, or inherited from his parents

rents) the tone of some necessary or considerable part of the Body, being thereby rather abolished, than barely vitiated, it were a folly to promise recovery to such a Patient. And on the other side, a moderate *Galenist*, that is not unacquainted with the Discoveries which these latter Ages have made of the power of Nature and Art, will not be forward to pronounce (as others do, and as the *Paracelsians* tax the *Galenists* too indiscriminately for doing,) That the Gout (for instance) the Dropsie, and the dead Palsie, the Stone, are Diseases universally incurable; since the Writings of *Erastus*, and in the Observations of *Schenkius*, and others, there are Instances recorded of some Cures performed of the Dropsie, and one or two more of those stubborn Diseases, even by *Galenical* Remedies.

But, *Pyrophilus*, though we cannot but disapprove the vain-glorious Boasts of *Paracelsus* himself, and some of his Followers, who, for all that, lived no longer than other men; Yet I think Mankind owes something to the Chymists, for having put some men in hope of doing greater Cures than have been formerly aspir'd to, or even thought possible, and thereby engage them to make Tryals and Attempts in order thereunto. For not onely before men were awaken'd and excited by the many Promises and some great Cures of *Arnoldus de Villanova*, *Paracelsus*, *Rulandus*, *Severinus*, and *Helmont*, many Physicians were wont to be too forward to pronounce men, troubled with such and such Diseases, incurable, and rather detract from Nature and Art, than confesse that those two could do what ordinary Physick could not; but even now, I fear, there are but too many, who though they will not openly affirm, that such and such Diseases are absolutely incurable, yet if a particular Patient, troubled with any of them, be presented, they will be very apt to undervalue

That the hope of doing greater Cures than ordinary, hath engaged Artists to make profitable Tryals.

dervalue (at least) if not deride those that shall attempt and hope to cure him.

And I am apt to think, that many a Patient hath been suffered to die, whose life might have been saved, if Physicians would have but thought it possible to save it. And therefore I think it were no ill piece of service to Mankind, if a severe Collection were made of the Cures of such persons as have recovered of having been judged irrecoverable by the Doctors; that Men might no longer excuse their own ignorance by the Impotency of Nature, and bear the World in hand, as if the Art of Physick, and their Skill, were of the same Extent. And the Cures that seem performed by Nature herself, need not be left out of such a Collection: For still they shew what is possible to be done by natural means, to evacuate the Morbifick matter, or alter its Nature (how dangerous soever it is grown,) or how far the tone of a part, or strength of the Body may be vitiated or impaired, and yet be capable of some restitution. And such an observation I received from our most experienced *Harvy*, when, having consulted him about my weak Eyes, he told me, among other things (as a very remarkable one) that he had once a Patient (whose Name and Profession he told me, but I remember not) that had a confirm'd Cataract in his Eye, and yet upon the use of Physick, to which he could not ascribe so wonderful an effect, that Cataract was perfectly dissipated, and the Eye restored to its wonted function. Which brings into my mind another Observation, imparted to me a while since, by that excellent and experienc'd Lithotomist, Mr. *Hollyer*, who told me, that among the many Patients sent to be cured in a great Hospital (of which he is one of the Chirurgions) there was a Maid of about eighteen Years of Age, who, without the losse of motion, had so lost the Sense of Feeling in the external parts of

Examples of
some unexpected
and strange
Cures.

her Body, that when he had, for tryal sake, pinn'd her Handkerchiefe to her bare Neck, she went up and down with it so pinn'd, without having any Sense of what he had done to her. He added, That this Maid having remained a great while in the Hospital without being cured, Dr *Harvey*, out of Curiosity, visited her sometimes, and suspecting her strange Distemper to be chiefly Uterine, and curable onely by *Hymeneal Exercises*, he advised her Parents (who sent her not thither out of poverty) to take her home, and provide her a Husband, by whom, in effect, she was according to his Prognostick, and to many men's wonder, cured of that strange Disease. That in acute Sickneses, persons given over by the Physicians, may recover, the more judicious, even of those *Galenists* that are of a despondent temper will not deny. For not onely *Celsus* gives us this sober admonition, *Neg. ignorare oportet in acutis morbis fallaces magis notas esse & salutis & mortis*: But even *Hippocrates* himself, who was so skilful in Prognosticks, confesses, that *Morborum acutorum non in totum certa sunt prænunciationes neg. salutis neg. mortis*: Whence the French have a Proverbial Saying, that *Il vaut mieux estre condamné par les Medecins, que par le Prevost des Mareschaux*, as if in English we should say, *It is better to be condemned to dye by the Doctor, than by the Judge*. And even in Chronical Diseases, where events are wont much better to answer Physicians predictions, there are sometimes such Cures performed, as may encourage humane industry, and keep a sick mans friends from forsaking the Cure of him, till Life it self hath unquestionably forsaken him. For not only it hath been not unfrequently seen, that divers persons, who have been given over by some Physicians, have been cured by others, perchance rather more lucky than more skilful; But those that have been given over, and that too (sometimes rather upon the believ'd incurableness of the Disease, than the personal

Examples of
Cures of Can-
cers.

personal Condition of the Patient) even by judicious and experienced Physicians, if such as are acquainted but with the ordinary Remedies, have been recovered by the use of extraordinarily powerful, and especially, Chymical Physick. Of such Cures I have sometimes met with a few, which, because I may elsewhere relate, I shall now onely mention, on this occasion, what I have heard concerning the Cures of Cancers, performed by Dr. *Harberfeld*, one of the principal Physicians of *Bohemia*. And among other relations of this kind, made me by credible persons, I cannot omit one, that was of a certain English Woman, of sixty and odd years of age, who had long lain in an Hospital in *Zeeland*, sick of a Cancer in the Breast, and by this Doctor was, with one single inward Remedy, perfectly cured in the space of three Weeks. For this relation was made me by persons of very strict veracity, the one a Doctor of Physick, who was an Eye witness of the Cure; the other a Child of *Cornelius Drebell's*, who not onely saw the Cure, but knew the Woman before, and out of Charity brought her to him that healed her. The same persons likewise informed me, That the Chymical Liquor the Doctor constantly made use of, does, in the dose of about a Spoonful or two, work suddenly and nimbly enough by Vomit, but hath very quickly ended its operation, so that withe in an Hour or lesse, after the Patient hath taken it, he is commonly well again; and very hungry. And they having presented me some Spoonfuls of this Liquor, I find the Taste to be offensive enough, and not unlike that of Vitriol, which, by the Taste and Emetick Operation, I guesse to be, at least, its principal Ingredient, however it be prepared. The same persons assured me, that having obtained of Dr. *Harberfeld*, a good quantity of his Specifick, they had been (in *England*, as well as elsewhere) partly Eye-witnesses, and partly Performers of wonderful cures by the help of it alone under God,

God, in the Kings Evil. Inſomuch that an eminent Gentleman of this Nation, now alive and healthy, hath been cured by it, when the Kings Evil had brought his Arm to that paſs, that the Chirurghion had appointed a time to cut it off. And with the ſame Liquor, onely taken inwardly, they profeſſe themſelves to have ſeen and done divers Cures of inveterate external Ulcers, whoſe proud Fleſh, upon the taking of it, is wont to fall off, and then the Ulcer begins to heal at the bottom; but of the recent effects of this Liquor, we may elſewhere, perhaps, further entertain You. That Suffuſions or Cataracts, may, by a mutual operation, be cured even in a Patient that was born with them, I formerly told You, when I related the Cure done by my Ingenious Acquaintance, Mr. *Stepkins*, on a Gentlewoman of about eighteen Years of age, that brought a couple of Cataracts with her into the World. And I remember I was ſomewhile ſince in the company of another Woman, who told me, She was brought to bed of five Children (if I much miſtake not the number) ſucceſſively; of which ſhe ſaw not any in a long while after, by reaſon of a couple of Suffuſions, that had many Years blinded her; and yet now, by the help of a Dutch Oculiſt of my Acquaintance, ſhe ſees, and reads well, and hath freely enjoyed the reſtored uſe of her Eyes for ſome Years already.

An example of the Cure of one that was born with a Cataract in the Eye.

And other Examples of Cataracts ſtrange-ly cured.

But theſe are rather Chirurgical, than Medicinal Cures, and therefore we ſhall ſubjoyn the mention of a very memorable Obſervation of the Learned *Petronius*, which being collated with that a little above recited, from Dr. *Harvey*, they may ſerve to keep each other from paſſing for incredible: *Quidam* (ſayes our Author) *qui antequam morbo Gallico afficeretur altero oculo cæcus erat, ſuffuſione denſiſſima (vulguſ Cataram vocat) oculum occupante, Hydargyri inunçãoe à Morbo Gallico, et à ſuffuſione, quod maximè mirum eſt, evaſit. Neque à ratione alienum eſt inunçãoe illa Cataractas poſſe diſſolvi, cum*

Alexand. Trajſſ.
Petronius lib. 5.
De Mor. Galli-
co c. 1. apud
Scheckauum in
Obſerv. l. 1.

fre-

frequens Experientia doceat præduros tumores ex pituita crassa & concreta genitos, illius Hydrargyri potenter dissolvi.

Examples of the
Cure of the
Dropfy & Gout.

I need not tell You what sad Prognosticks Physicians are wont to make of Dropfies, especially of that sort which they call *Ascites*. And indeed the Event does but too frequently justifie their Predictions, when none but ordinary Remedies are employed. But I remember, that being acquainted with an ingenious person that was very happily cured of a Dropfie, and inquiring who it was that had perform'd the cure; I was inform'd, that that, and a multitude of the like had been wrought by a German Physician, of whom, and of his Remedy, I had heard much Commendation in *Holland*, where he lived. And though on diverse occasions I found him a Modest man, and accordingly, when I asked him concerning his Cures of the Dropfie, he answered me, That he neither did, nor would undertake to cure so formidable a Disease, yet he scrupled not to tell me, That as far as he had hitherto tried, he had one Remedy which had not failed him, though he had tryed it upon persons of differing Ages, Sexes, and Complexions. But of this Specifick more hereafter. For, at present, I must proceed to take notice, that as incurable a Disease as the radicor'd Gout is thought to be (especially in Patients not very temperate) and as tedious a course of Physick as one would expect to be requisite to the Cure of it, in case it can be cured; yet I have been several times visited by an honest Merchant of *Amsterdam*, who was there noted for his Wealth, and his skill in *Arte tinctoria*. This man, ten or twelve years ago, had been for a long time so tormented with the Gout, both in Hands and feet, that his Fits would sometimes vex and confine him for a great part of the Year, and not leave him without hard knots, as unwelcome pledges of their Return: But once, that he was tortured to a degree that made him much pitted, one came and informed him of an Emperick, who had received

received from a great Chymist, who had lodg'd in his House, a Secret, with which he had already thoroughly cured many in a short time: whereupon sending for this person, and offering him any thing for some relief, the other refused to take above ten Crowns, which, as it seems, was the usual rate for the Cure, and would not receive that neither, till the reality of it had been evinced by the Patients continuing above six Moneths well. And accordingly, with a very few Doses of a certain Powder and Tincture, the Merchant was quickly freed, not only from his pains, but from his Gouty Tophy. And though he indulged himself the drinking of Rhenish Wine very freely, yet he never had a Fit since, as himself assured me one Morning, wherein for Exercise sake, he walked five or six Miles to give me a Visit; adding, That the Man that cured him, dying suddenly, never could discover what the Secret was, wherewith so many had been freed from a Disease that does so often mock the skill of the greatest Doctors,

I might, perhaps, if I had leisure, relate to you some other strange Stories, which may invite you to think, That as the Naturalist's skill in Chymistry, and other Arts relating to Physiology, may much assist him to discover more generous Remedies than are yet usual; so the Knowledge of such Remedies may, in diverse Cases, make a happy Change in the Rules of Prognosticating what will prove the Course and Event of a Sicknesse. But I shall not, at present, particularly consider any more than one Disease, namely, The Stone in the Bladder. For whereas it is by most, even of the judicious Physicians, unanimously pronounc'd incurable by Physick in what person soever, if it deserve the name of a Stone, and betoo big to be voided whole, the remedilessness of this Disease may be justly questioned. I remember the famous *Morhardes*, treating of the Seed of a *Peruvian* Plant, which they call *Chalchoos*, tells us, That it is highly esteemed by the In-

Examples of the
Cure of the
Stone.

habitants of the County it grows in, and affirmed not onely to be Diuretick, and to bring away Gravel, but to break the Stone in the Bladder it self, if it be not too much hardened: *Ejusq; rei* (addes he) *tam multa proferunt exempla ut admirationem mihi pariat.* He tels us indeed, that he is of opinion that nothing but Section can cure the Stone of the Bladder. *Aiunt tamen,* saith he, *illius semen* (of the Chalchoos) *tritum, ex aqua aliqua ad eam rem idonea sumptum, calculum in lutum dissolvere, quod excretum denuo concrescit & in lapideam duritiem convertitur.* *Adolentem vidi cui hoc obtigisse scio;* is cum vesica calculo torqueretur, idq; à Lithotomis qui calculum deprehenderant intellexissem, & ex Symptomatis qua patiebatur agnoscerem, hominem, veris intio, ad fontem, qui à Petro nomen habet, ablegavi, ubi cum duos menses hasisset, à calculo liberatus redit, et lutum omne quod paulatim eiecerat, denuo in lapidum fragmenta concretum in charta secum retulit. Which passage I wonder such a Writer should immediately annex, to the Declaration of an Opinion that must appear Confuted by it, to a Reader that considers not so much what is thought, as what is proved.

The very learned and experienced Dr. Gerard Boot, of whole skill You, *Pyrophilus*, have found very good effect in Your Self, and who was one of the two Professors that writ the *Philosophia naturalis reformata*, had a very famous Remedy (which now he is dead, I intend, God willing, to communicate) against the Stone; and with it he told me that he had very often cured that Disease in the Kidneys: but for the Stone in the Bladder, he thought it impossible to be dissolved; which circumstances I recite, that you may the more readily believe what he told me a little before his death; namely, That he had cured lately one Mr. *Moulin* of a real Stone in the Bladder; adding, That he could not brag of being the Inventor of that Remedy he had employed, having but lately learned it of a Country

Countrey Gentleman, whom going to visit last Summer, he saw a Load of *Periscaria*, or *Arsmart*, brought to him by some of the Countrey People, and desiring to know what he intended to do with so vast a quantity of it, the Gentleman replied, That he yearly used as much, having by the Water of it, made by bare distillation in a common Rose-water Still cured so many of the Stone, even in the Bladder, that he was usually solicited by Patients, numerous enough, to exhaust all the Liquor which he yearly prepared.

The use of *Periscaria* for that Cure.

What we, *Pyrophilus*, have observed concerning this excellent Liquor, of which we use to prescribe a draught every morning for some Moneths together, we may elsewhere have occasion to relate. But now we shall go on to tell you, that being some Years since in *Ireland*, I met with an Ancient Emperick, who was very famous in those parts, for cutting of the Stone of the Bladder, and for curing sore Eyes. This Man having given (in the parts where I then was, and whilst I was there) some good proof of his skill, I sent for him to me, upon the account of a Suspicion I long had of the Stone in the Bladder, which, upon search, he assured me I was free from, and so (God be praised) I have afterwards found it. He was more a Traveller than a Scholar, and yet finding him, to my wonder, very modest and sober, I inquired of him, Whether he had never any where met with a Remedy that could dissolve the Stone in the Bladder, offering him much more for a Cure of that kind, than he would require as a Lithotomist: He answered me, That he could cure no Man of a confirm'd Stone, but by the help of his Knife; but if the Stone consisted of a lump of Gravel not very firmly cemented together, he had, by a certain inward Remedy he used, and a dexterous way of crushing the Stone from without with his Fingers, so broken the Stone, partly by crumbling it, and partly by dissolving the Cement, as to make it avoidable by Urine. And he

he added, That he had formerly cured a Citizen of *Cork*, of a good large Stone of the Bladder, (for where I then was, he gave a proof of his skill, in telling before hand, those he was to cut, the bignesse and shape of the Stones that troubled them.)

Instances in o-
ther happy me-
dicines for the
same Disease.

Passing afterwards by *Cork*, I sent an intelligent Servant to inquire after this Citizen; but he being casually absent, his Wife sent me, by my Man, a Relation very agreeable to that which he had made me. The Receipt I purchased of him, and though it seem not very Artificial, yet I suppose You will not quarrell with me for annexing so experienced a one, to the end of this Essay. But because this Remedy needed the assistance of a manual operation, we shall further proceed to tell You, That *Cardan*, as he is quoted by *Helmont* (for I have not now his Works by me) relates, That in his time there rambled a Man over *Lombardy*, who did commonly, and in a few dayes, by a certain Liquor which he administred to his Patients, safely, speedily, and certainly, cure those that were troubled with the Stone in the Bladder: Adding (saith *Helmont*) his judgment, That he doubted not of this Man's being in Hell, for having, when he dyed, envied Mortals so excellent an Art.

De Lib. c. 7.
Num. 14.

I insist not on the Testimony that the same *Helmont* gives to *Paracelsus* of his curing the Stone, though he often handle him very severely in other places of his Writings, because that the Epitaph of *Paracelsus* (out of which he labours to prove his having cured the Stone) makes no expresse mention of it. Nor shall I enumerate those Passages from whence the same *Helmont's* Followers collect, That he himself was able to cure that Disease, by the resolution of *Paracelsus* his *Ludus*; but this Experience hath evinced to me, that a much slighter preparation of that Stone, than was mentioned by *Paracelsus* and *Helmont*, hath been able to do more in that disease than a way
Man

Man would readily believe. But to detain you no longer on this subject, I shall onely adde, That *Wilhelmus Laurebergius*, a learned Physician, and Professor at *Rostoch*, hath told the World how he cured himself of a confirmed Stone of the Bladder, by the use of prepared *Millepedes* (by some in *England* called *Woodlice*) and other Remedies, which he hath particularly recorded in the History which he hath published, and I have seen of this admirable Cure: which having been epitomized by *Sennertus*, and other eminent Physicians, I shall not need to insist on it. And the Arguments alledged (even by the most judicious) against the Cureableness of the Stone, though very plausible, seem not to me unanswerable; for whereas first, they appeal to the innumerable fruitlesse Attempts that have been made to cure great Princes, and rich Men, without Cutting, that Argument drawn from Experience, may, by the former Experiments, be answered; especially since *Horatius Augenus* (upon whose account *Laurebergius* tryed *Millepedes*) tells us, not onely that he cured a Young Man at *Rome*, that was going to be cut of the Stone, but that the Jesuite that chanced to confesse this Youth, and perswaded him to the use of *Millepedes*, had experimented their efficacy both upon himself and others. And indeed we our selves have found them to be highly Diuretick and Appetitive.

The use and
successe of *Mil-
lepedes*.

And whereas it is next objected, That Medicines must necessarily lose their efficacy before they can reach the Bladder, I confesse, that for the most part, it is very true: but yet that it is possible for some Medicines to retain their Nature, after many Alterations and Digestions, we have elsewhere declared. And in our present Case, we not onely find that Turpentine and Asparagus, do manifestly affect the Urine (as I have often observed in my own, and almost any man may observe it
in

The Argument
concerning the
incureableness of
the Stone an-
swered,

in his.) But that which is most to our purpose, *Rubarb* ti nge the Urine of those that have taken any quantity of it. And lastly, whereas it may be yet further alledged, That not onely there hath not been yet a Liquor found capable of dissolving so solid a Body as a Stone; but if there were, it must necessarily be so corrosive as to destroy the Patient, by fretting his Stomach, or Guts, or Bladder, which are parts so much more tender. To the first part of this plausible Objection it may be replied, That even good Vinegar will dissolve, not onely those stony Concretions, called *Lapides Cancrorum*, which, like the *Calculi* we treat of, are formed in the Bodies of Animals, but even the more hard and solid Body of Coral, which will loose but little of its Weight, in a Fire that would wast a great part of the *Duclech*: And that the bare juices of Vegetables (such as Lemmons and Barberries) will readily dissolve both Pearl and Coral, is known even to the Apothecaries Boys. Indeed what *Paracelsus* and *Helmont* relate of their *Alkabeft*, with which they prepare their Specifick against the Stone, and with which the latter of them, if not both, pretend to be able to reduce, not onely the Stone they call *Ludus*, but all other Stones, Vegetables, Minerals, Animals, &c. into insipid Water, is so strange (not to say incredible) that their Followers must pardon me, if I be not forward to believe such unlikely things, till sufficient Experience hath convinced me of their Truth.

But yet I must not concele from You, That a Chymist, whom You have often seen, advised with me several times about the way of preparing this immortal liquor (as *Helmont* calls it) and that, when we had agreed that such a way was the most promising, he prosecuted it so long, and so industriously, that at length he obtain'd, & shew'd me a liquor, which (though it seem'd to me far short of the *Alkabeft*) I confesse I

ad-

admired; and not I alone, but our Ingenious Friend Dr. C: (who had been imployed into several parts of *Europe*, by a rich and curious Princess, to purchase Rarities) agreed with this Chymist, to give two Hundred Crowns for a Pint of this *Menstruum*, and confessed to me withall, That he saw him, with this Liquor, not onely dissolve common *Sulphur*, and bring it over the Helm, but reduce Antimony into sweet Chrystals: with a few of which it was, that he (I mean Dr. C.) to the wonder of many, did, without Purge or Vomit, cure our good Friend Sir C. C. of a very radicated and desperate Disease, as the restored Patient soon after told me. And to the second part of this Objection it may be answered, That if we knew and considered well, how many of the Operations of Natural Bodies depend upon the suitableness and difference of the figures of their parts, and the Pores intercepted between them, the number of impossibilities would not, perhaps, be thought so great, as by many Learned men it is.

That it is very possible for a Body to have an effect upon another determinate Body, without being able to operate in like manner upon a multitude of other Bodies, which may seem more easie to be wrought on by it; may appear by the Load-stone, which will draw and worke onely upon Iron, and (which is but refined Iron) Steel, but not upon wood or straws or any of those innumerable Concrets that are lighter, and of a more open Texture than the heavy and solid body which it attracts. And to give you an instance that comes nearer to our case, Quick-silver, that will not corrode our skin, nor so much as taste sharp upon our tongue, will yet readily dissolve that most compact Body of Gold, which even *Aqua fortis*, that can insinuate it self into all other Metals, and corrode them, will not meddle with; though the same Quick-silver will not dissolve Iron, which yet *Aqua fortis* will very nimbly

That there may be a liquor able to dissolve the Stone, that may not be corrosive to any other part.

fret asunder. So that although I dare not confidently believe all that I have found averr'd even by eminent & learned Chymists, of their having made or seen Liquors, which, without appearing any way sharp to the Tongue, would dissolve Gold and Silver, and other hard compact Bodies; because I have not yet my self seen any severe and satisfactory trial made to evince the efficacy of insipid Dissolvents: yet, by reason of divers things I have read and heard, and of some things too I have seen, I dare not peremptorily deny the possibility of such *Menstruums*. And who knows, but that in Nature there may be found, or by Art there may be prepared, some Liquor, whose parts may have such a suitableness to the Pores of a humane *Calculus*, as those of Quick-silver have to the Pores of Gold, and yet may as little work upon the rest of the Body, as we have observed the same Quick-silver to do upon Iron (which yet is a much more porous and open Metal) even when it hath been distill'd in Iron Vessels? And as to that part of the Objection wherein the strength of it chiefly lyes, let me tell You, *Pyrophilus*, that I have sometimes, for Curiosity sake, taken an Egg, and steeped it in strong Vinegar for some dayes, and by taking it out, and shewing that the Shell was so eaten away, that the Egg could be squeez'd into unusual Forms, but the thin skin that involves the White continued altogether unfretted, I convinced an ingenious Man, That the Operation of Dissolvents are so determin'd by the various Textures of Bodies on which they are imploied, that a Liquor, which is capable to corrode a more hard and solid Body, may be unable to fret in the least another more soft and thin, if of a Texture indisposed to admit the small parts of the *Menstruum*. And I must confess to you, *Pyrophilus*, that one thing, among others, which hath made me backward to affirm with many Learned men, that there can be

no potent Dissolvent that is not corrosive enough to fret in pieces the parts of a humane Body, hath been a story, which I divers Years since chanc'd to meet with in the learned *Sennertus's Paralipomena*, where, though he relates it to another purpose, yet it is so pertinent to our present design, and in it self so singular, not to say matchless, that I cannot forbear to mention it here on this occasion. He tells us then, That in the end of the Year 1632, *Johannes Nesterus*, an eminent Physician, and his great Friend, informed him, That there liv'd at that time in the Neighbourhood, and belonging to a Noble-man of those parts, a certain *Lorrainer*, whom he also called *Claudius*, somewhat low and slender, and about 58 years of age. *Hic* (saith he) *nihil fatidum, nihil injucundum abhorret; Vitra, Lapides, Ligna, Carbones, Ossa, Leporinos, & aliorum animalium pedes cum pilis, lineos, lancosq; pannos, viva animalia, & pisces adhuc salientes, imò etiam Metalla, patinas & orbes stanneos dentibus confringere & vorare sapissimè visus est. Vorat præterea lutum, serum & candelas sebaceas, integras testes coclearum, animalium stercora, cum primis bubulum calidum adhuc, prout è matre venit: potat aliorum Urinas cum Vino & cerevitia mixtas. Vorat fœnum, stramen, stipulas, & nuper duos mures viventes adhuc deglutivit, qui ipsius ventriculum ad semihoram usq; creberrimis moribus lancinarent; & at brevibus completar, quicquid illi à Nobilibus devorandum offertur, vilissimà mercede proposità, dictum ac factum, ingurgitat, ita ut intra paucos dies integrum vitulum crudum & incoctum cum corio, & pilis se estaturum promiserit. Testes inter alios quamplurimos ipse ego sum, quippe qui, &c.* To this and the following part of the Letter, *Sennertus* adds, That not having, during some years, heard any thing concerning this *Claudius*, he sent about four Years after to the same Physician, *Dr. Nesterus*, to enquire what was become of him; and

Examples of those who could digest metals and Glasse.

Medicus Roch-lizeasis.

that the Doctor sent him back a Letter of the Minister of the Church of that place, by way of confirmation of all the formerly mention'd particulars, and answered himself, That the *Lorainer*, whom he had long hoped to dissect, was yet alive, and did yet devour all the things mentioned in his former Letter, but not so frequently as before; his teeth being grown somewhat blunter by age, that he was no longer able to break Bones and Metals. Some other Examples of this nature, though none so strange, we have also met with in Writers of good credit, and especially that of the Glass-eater, recorded by *Columbus* in his excellent Anatomical Observations; of which also *Senertus* makes mention, as we shall see by and by, and with which we may elsewhere entertain you to another purpose. And not long ago there was here in *England* a private souldier (who, for ought I know, is yet alive) very famous for digesting of Stones. And a very inquisitive man, that gave me the accuratest account I have met with concerning him, assures me, That he knew him familiarly, and had the curiosity to keep in his company for 24 hours together to watch him, and not onely observ'd that he eat nothing in that time, save Stones (or fragments of them) of a pretty bignesse, but that his grosse Excrement consisted chiefly of a Sandy Substance, as if the devoured Stones had been in his body dissolved and crumbled into Sand, But let us not omit, that to the second Epistle above mentioned, *Sennertus* addes this Reflection, not impertinent to our purpose: *Causam* (saies he) *hujus voracitatis, etiam in cadavere, invenire proculdubio erit difficillimum. Posset quidem ad illud, quod in cadavere Lazari vitri voracis observavit Columbus, quidam confingere; & statuere quartam illam nervorum conjugationem, quæ gustus gratia in hominibus à natura producta est; neq; ad Palatum, neq; ad Linguam pertendere. Verum hoc modo saltem gustus aboliti causæ redderetur,*

non.

nondum vix causa daretur, cur res tam miras assumere sine ventriculi latione, imò concoquere poterit. Quæ procul dubio in idiosyncrasia & peculiari constitutione ventriculi et intestinorum quærenda esset: quæ tamen oculis investigari non potest, sed saltem ex effectu patet. And indeed this memorable story seems to argue, not onely what we have already alledged it to prove, but also that a Menstruum not so corrosive as to fret the Body, may dissolve Stones, Metals, and other compact Substances. And since one Liquor, prepar'd by Nature onely, could in this Man's Stomach dissolve that great variety of Bodies above enumerated, why should it be thought that the Alkalest, or some other Menstruum wherein Nature is skillfully assisted, and to the utmost heightned by Art, should not be able to dissolve Concretes of very differing Textures. For though Chymists must acknowledge that such common Menstruums as will dissolve one Body, will not oftentimes meddle with another; as *Aqua fortis* will dissolve Silver, and not Gold; and if by *Sal Armoniack* you turn it into *Aqua Regis*, it will indeed dissolve Gold, but then it will not Silver: Yet since that may be supposed to proceed rather from our want of skill to prepare the most potent Menstruum, than from the impossibility of one Menstruum's dissolving great variety of Bodies; why may not Nature and Art afford a Menstruum, whose variety of Parts and Figures, and, perhaps also, Motion, may give it ingresse into bodies of very differing Textures? as in our former instance, though *Aqua regalis* will dissolve Gold, not Silver; and *Aqua fortis* Silver, but not Gold; yet Quick-silver will dissolve both, and Copper, Tin, and Lead to boot.

If I were not at present under some restraint, I might tell you some things that you would, perhaps, think no weak Confirmations of the past Discourse. And however, since I

have observed it to be the main thing that keeps judicious Men from seeking, or so much as hoping for nobler Dissolvents, that they are scarce to be perswaded there can be considerably piercing *Menstruums*, that are not so proportionably corrosive: I will here acquaint You with a Liquor, that may, I presume, assist you to undeceive some of them. We take then ordinary household brown bread (I like that of Rye, but I have divers times used that of Wheat) and when it is cut into slices, and somewhat dried, we almost fill a Glass-Retort with it, and placing that in a Sand-Furnace, by degrees of Fire we draw off what will be made to come over, without much difficulty. The Oyl, as uselesse to our purpose, being by a Tunnel, or a Filter, severed from the rest of the Liquor, we also, by a gentle heat, free the Spirit from some of its Phlegm, which yet sometimes we find no great necessity to do. And yet this Spirit, which you will easily believe is no such Corrosive as *Aqua fortis*, or other distill'd Liquors of Mineral Salts, will work upon the hardest sorts of Bodies, and perform things that Chymists, counted of the judiciousest, would not have us expect from the most sharp and corrosive *Menstruums* now in use. For with this we have, in a short time, and that in the cold drawn Tinctures (which is done by the Solution of the finer parts of the Concrete) not only from crude Corals, & some of the more open Minerals, but likewise from very hard Stones, such as Blood-stone, and Granates (even unpowder'd.) Nay, & though Rubies seem to be the hardest Bodies yet known, save Diamonds, (for I have learned from those that cut precious Stones, that they can grind other Gems with the powder of Rubies, but not these with any Powder, save their own, and that of Diamonds) yet have, even these afforded me in the cold, a not ignoble Tincture. And not to anticipate what I may elsewhere have occasion to tell you concerning the

The description of a *Menstruum* prepared from a common bread, able to draw tinctures from precious stones, minerals, &c,

the efficacy of this *Menstruum*, which is the same that I have intimated, without naming it, in the last and another of the former Essayes: I shall now onely adde, That an expert Chymist assures me he hath, but tels me not how, done greater matters with it, or the like; and that to satisfy my self that these high Tinctures, proceeded not from the standing or digestion of the *Menstruum* (as we elsewhere observe concerning some other Liquors) I not onely tryed, that from some Minerals it will draw a much higher Tincture than from others, and from some scarce any at all, but that it would, if kept by it self, for many Moneths continue clear and limpid. What further use I have made, or think others may make of this odde *Menstruum*, I must not, as I said at present, expresse; but returning to what I was discoursing concerning the cure of the Stone, annex, That besides what hath been objected against the possibility of making a Liquor, which without being highly Corrosive, can be able to work upon Stone; it may indeed be also alledged against the hopes we seem to countenance, that what hath cured the Stone in one Man's bladder, may be unable to doe the like in anothers. But first, the truth of that hath not been proved; and next, we highly value those Specificks that can remove Agues, Fluxes, and the like Diseases, though scarce any of them do alike succeed in all Patients, especially so as to secure them, during their whole lives, from ever relapsing into the like Disease; and besides all this, it will be no small matter to find, that the Disease, in its own nature, is not incurable; and it would recompence Mens Industry to be able to free, even a few Patients, from so painful and stubborn a Disease. Which I have rather than any other, chosen to insist upon, because it is so generally believed not to be curable by inward Remedies in any Person whatever.

But

Helmont's Argument from the providence of God censured.

But I have entertained You so long on this subject, that I must reserve, for some other opportunity, what I have to say to you concerning the Dropsie, and some other Diseases, commonly put into the Catalogue of the incurable ones, and therefore shall now onely tell you in general, That as on the one side I think the Arguments which *Helmont* and others draw from the Providence of God, for the curableness of all Diseases, are not very cogent, and somewhat irreverent, (for God being not obliged any more to continue Life or Health to sinful Man than to Beasts that never offended Him, we ought humbly to thank him, if He hath, among his Creatures, dispersed Remedies for every Disease, but have no right to accuse him if He have not;) so on the other side, I am not much convinced by the grand Argument alledged against *Paracelsus*, and the Chymists, that hold all Diseases to be in their own Nature curable, namely, That they themselves many of them, (no nor even their very Master) lived not to the Age attained by many Strangers to Chymistry.

The Argument that *Paracelsus* outlived not the 47th. year of his age answered.

For this, That many of them (not destroyed by War, or outward accidents) dyed young enough, and consequently by Sicknesse, and that *Paracelsus* himself out-lived not the 47th Year of his Age, is a much stronger Objection against the Men, than against their Opinion; for it infers indeed plausibly, that they had not such Remedies as they boasted of (since probably, had they had any such, they would have cured themselves with them,) but concludes not that no such Remedies can be prepared by any other. And this you will be the less apt to think irrational, if you consider how much more learned, sober, and experienced it is possible for many a man to be, than *Paracelsus* appears to have been: For he seems not by his Writings to have been any great Logician

or

or Reasoner; he manifestly despised many parts of Learning useful to a Physician; he lived not many Years, and spent divers of those few which he lived, in an unsettled and disadvantageous course of life; and yet this *Paracelsus* attained to some such Remedies, as both in his own and after times, have made him a very considerable Person, in spite of all his indiscretions and deficiencies. And among his other Remedies, his famous *Laudanum* did such wonders, that *Oporinus* himself, in that short Account, which seems to be rather a Satyr than a Narrative of his Life, hath this passage of it: *De Laudano* (saith he) *suo (ita vocabat Pilulas instar Muri-um stercoris, quas impari semper numero, in extrema tantum morborum difficultate tanquam sacram Medicinam exhibebat) ita gloriebatur, ut non dubitavit affirmare ejus solius usu se è mortuis vivos reddere posse; idq; aliquoties dum apud ipsum fui, re ipsa declaravit* So signal a Testimony coming from one whom the *Paracelsians* call his fugitive Servant, hired by his Enemies to slander him under pretence of writing his Life, deserves not to be slighted: and though it manifestly contains an *Hyperbole*, yet I do the lesse wonder at the *Hyperbole*, by reason of those strange things which your Mother, and divers other of Your Friends, can tell You, they have seen performed in *England* by *Helmont's Laudanum Opiatum*, (though much inferiour to that of *Paracelsus*.) And I remember, that a Friend of Yours and mine, that is a great Enemy to all kinds of Chymical Remedies, and was before also to Chymistry, having begg'd of me a little Bottle of it, which I had obtain'd from a Friend of the younger *Helmonts*, to whom he communicated the Preparation, gave me a while after an account of such Cures that had been performed, with that small quantity, upon almost dying Persons, as I think it not discreet for me, that was not an

The efficacy of
Paracelsus his
Laudanum.

an Eye-witnesse of them, to relate. And I remember too, that the same Friend of young *Helmont's*, being, at the perswasion of one Woman whom he had cured of a dangerous Consumption, call'd to another that was thought to be dying of an *Asthma*, came to advise with me whether he should meddle with so desperate a Patient; telling me, That she had been many Years sick of that stubborn Disease, which, in proceffe of time, passing into an *Orthopnea*, had at last put her, by want of sleep (from which the violence of her sickness had very long kept her) into a Feaver, and so desperate a condition, that it was scarce expected she should live till the next morning. But I, representing to him that her Condition being avowedly desperate, he might exercise his Charity without danger to his Reputation; and perswading him to try *Helmont's Laudanum*, together with the Spirit of Man's Blood (which we elsewhere teach you to prepare) he gave her that Night a Dose of those Remedies, which made her both sleep and breath pretty freely; and a Week after, he coming to visit me, told me, he had casually met his Patient well and abroad in the Streets. But these are Trifles to the Cures which *Helmont* relates to have been performed by our *Iris* *Butler*: for he tels us, That this Man, by slightly plunging a little Stone, he had, into Almond-Milk or Oyl, imbued those Liquors with such a sanative Efficacy, that a Spoon-ful of the former cured (and that without acquainting him with what was given him) a *Franciscan Frier* (a very famous Preacher) of a very dangerous *Erysipelas* in the Arme, in one hour; and one drop of the latter being applied in his presence, to the head of an old Laundresse, that had been sixteen years troubled with an intolerable *Hemicrania*, the Woman was presently cured, and remained so to his knowledge for divers Years. He addes almost as strange a Cure done in one Night

Butler's great Remedies.

Helmont in the Treatise which he entitles *Butler*.

Night, upon a Maid of his Wifes, by anointing the part affected with four drops of that Oyl. He farther tels us, That the Master of the Glasse-house at *Antwerp*, being troubled and made unweildy with too much Fat, begged some relief of *Butler*; who, having given him a little fragment of his little Stone, with order to lick it nimbly with the tip of his Tongue once every Morning, I saw, saith *Helmont*, within 3 weeks, the compass of his Waste lessened by a span, without any prejudice to his health. And to these, *Pyr.* he addes some other Narratives, which, though I confesse I know not well how to believe, yet there are Circumstances which keep me from daring to reject them. For first, as he well observes, that which was most stupendous in this Remedy, was but the smalness of the quantity. Next, a Gentleman in *France*, being not long since reported to have a Fragment of this Stone, and to have cured several Persons (and especially one very dignified) of inveterate Diseases, by letting them lick it; my Noble Friend Sir *Kenelm Digby*, then in *France*, was solemnly requested from hence to inquire into the truth of that Report, and answered, That he could not, upon examination, find it other than true. Besides, *Helmont* not onely relates these Cures as an Eye-witnesse of them, but tels us, how upon an occasion that he mentions, he once suspected the efficacy of the Oyl, and that, without expecting that it should doe any thing, he anointed it on the right arm and the ancles of his own Wife, who had for some Moneths been tormented with great pains in the former, and very great tumors in the latter of those parts, and that almost in a trice, motion was restored to her Arm, and all the *œdema* of her Legs and Feet vanished; adding, That at the time of his writing she liv'd healthfully, and had done so since that recovery, during nineteen years. And this Story she, long after her Husband's death

death, confirm'd to our ingenious Friend Dr. C. who is acquainted with her, and much extols her. These Circumstances may be assisted by two more very considerable ones; the one is, That *Helmont* is the more to be credited in these Relations, because mentioning Cures not perform'd by himself, but by another, and that by Remedies unknown to him, he seems by these narrations, out of loyalty to truth, to eclipse his own Reputation: and the other is, that in a memorable Story, which we may elsewhere relate to you (it being not here proper to insert so long a one) you'll find an eminent and strange testimony given to *Butler's* Secrets, by our famous Countrey-man Dr. *Higgins*, whose Confession you will not doubt, if you consider how rare a Physician and Chymist he was, how familiarly he lived in the same House with *Butler*, and how studiously at last they endeavoured to take away each others Life.

But whatever be to be thought, *Pyr*: of *Helmont's* Relation, we may well enough make this reflection on the other things that have been delivered concerning formidable Diseases, That since the power of Nature and Skill may reach much farther than many distrustful (not to say lazy) men have imagin'd, it will not be charitable to rely too much upon the Prognosticks, even of famous Writers, when they tell us, That such and such Diseases, or Patients in such and such conditions cannot possibly be cured: but rather to follow the sober counsel of *Celsus*, *Oportet* (saith he) *ubi aliquid non respondet, non tanti putare Authorem quanti agrum, & experiri aliud atq. aliud*. And this great Physician's authority I therefore make the most use of in the ensuing Essays, because he is accounted very judicious by the Lord *Verulam*, and other Writers that are unquestionably so themselves.

De Medicina
lib. 3. cap. 10.



ESSAY IV.

*Presenting some Things relating to the
Hygieinal part of Physick.*

THat the Dietetical part of Physick, *Pyrophilus*, may, as well as the others, be improved by Natural Philosophy, were not uneasy to manifest, if my haste would permit it: For tis known, that Drinks make a very considerable part (sometimes, perchance, amounting almost to the one half) of our Aliments; and most Drinks, as Wine, Beer, Ale, Mead, &c. consist of fermented Liquors. Now as on the one side the ignorance of the Doctrine of Fermentation, and of the wholsom way of both preserving Liquors and making them pleasant, doth questionless occasion more than a few Diseases, which in divers places may be observed evidently to proceed from the unwholsom quality of either ill made or sophisticated Drinks; so on the other side, the distinct knowledge of the true nature and particular *Phænomena* of Fermentation, would enable men to prepare a great variety of Drinks, not onely as harmelesse, but as beneficial as pleasant.

How much preparation may do to correct and meliorate both hard and liquid Aliments, is notably instanced by the account that we receive from both the French and English that inhabit the *Barbados*, *St. Christophers*, and other *Caribby*

That the knowledge of Fermentation is useful to make our drinks wholsom for Aliment.

How much sim-
ples may be al-
tered by prepa-
ration, exempli-
fied by the *In-*
dians making
Cassavi out of
the poysonous
Plant *Mandioca*

Islands, who solemnly inform us (what is attested also by *Piso*, and other Learned Travellers that write of it) that the Plant *Mandioca* (whose prepar'd Root makes *Cassavi*, and which we have also seen flourishing here in *Europe*) to which the *Indians* are so much beholden, is a rank Poyson. And though I shall not too resolutely affirm it to be a Poyson properly so called; yet in confirmation of its being very noxious, I shall tell You, That having purposely enquired of a very intelligent Gentleman, who commanded an Army of *Europeans* in *America*, what Experience he had seen of the qualities of this Plant, he told me, That between thirty and fourty of his Souldiers, having on a time (whilst they were unacquainted with the Countrey) either through ignorance or Curiosity, eaten of it unprepared, it cost most of them their Lives. And yet this pernicious Root, which some Herbarists call *Tucca*, by the rude *Indians* ordering, comes to afford them both almost all their Bread, and no small part of their Drink. For this Root being grated, and carefully freed from its moisture, by being included in Bags, and very strongly pressed till all the Juice be squeezed out, it is afterwards dyed in the Sun, and so made into the Meal of which they make their Bread. And this very Root, though (as we said) it be poysonous, they cause their old and almost toothlesse Women, for the better breaking and macerating it, to chew and spit out into Water. This Juice will, in a few hours, work and purge it self of the poysonous quality, affording them a Drink which they esteem very wholesom, and at the *Barbados* call *Perino*, and account it to be the likest in tast to our English Beer, of any of those many Drinks that are used in that Island.

This nasty way of preparing Drink, *Pyrophilus*, may seem strange to You, as it did to me when I first heard of it; but

Odd unhand-
some wayes of
their making
drink from the
same Root.

History of the
Barbados pag.
29, 30, 31, 32.

but besides the consenting relations both of French and English concerning it, it may be confirmed by the strange assertion of *Gulielmus Piso*, in his new and curious *Medicina Brasiliensis*, where, having spoken of several of the *Brasilian* Wines, he tells us, That they make Liquors of several Plants besides the Root of *Mandioca*, after the same nasty manner.

Idem fit (saith he) *ex Mandioca, Patata, Milio, Turcico, Oryza, & aliis, quæ à vetulis masticantur, masticatæq; multa cum saliva exspuntur; hic Liquor mox vasis reconditur, donec feruat, facisq; ejiciat.*

Voyage de Mascovie & de Perse, p. m. 23.

In *Muscovia* it self, notwithstanding the unskilfulnesse of that rude People, *Olearius* informes us, That the Embassadors, to whom he was Secretary, were presented at one time with two and twenty several sorts of Drink. And at a Countrey-house here in *England* (where I was, by a very Ingenious Gentleman that is Master of it, presented with divers rare Drinks of his own making,) I was assured, that he had lately, at one time in his house, at least the former mentioned number of various Drinks, and might easily have had a greater, if he had pleased.

And on this occasion, I am not willing to pretermitt what is practised in some of our *American* Plantations, as I am informed by the Practisers themselves, where, finding it very difficult to make good Mault of *Maiz*, or *Indian* Corn, (by reason of hindrances not to be discoursed of in few words) they brew very good Drink of it, by first bringing the Grain to Bread; in which operation, the Grain being both reduced into small parts, and already somewhat fermented, is disposed to communicate easily its dissoluble and Spirituous parts to the Water it is boyled in. To which I shall adde, That I have to think, that the Art of Malting may be much improved by new and skilfully contriv'd Furnaces, and a rational management of the Grain.

Of making Drink from sorts of course Bread.

Not

Nor are we alone defective in the knowledge of fermenting Drinks, but even in that of the Materials of which Drinks may be prepar'd.

The Drinks in
use in *China*.

History of *Chi-
na*, part. 1. c. 1.

Linschoten's
Voyages, Book
1. Ch 26.

Of Cherry
Wine.

In that vast Region of *China*, which is enriched with so fertile a Soil, and comprizeth such variety of Geographical Parallels, they make not (as *Semedo* informs us) their Wine of Grapes, but of Barley; and, in the Northern parts, of Rice, where they make it also of Apples: but in the Southern parts, of Rice onely; yet not of ordinary Rice, but of a certain kind peculiar to them, which serves onely to make this Liquor, being used in divers manners. And of the Wine there drank, even by the Vulgar, our Author gives us this Character: The Wine used by the common people, although it will make them drunk, is not very strong or lasting; 'tis made at all times of the Year, but the best onely in the Winter: it hath a colour very pleasing to the sight, nor is the smell lesse pleasing to the Scent, or the savour thereof to the Taste; take altogether, it is a vehement occasion that there never wants Drunkards &c. And of the Inhabitants of the Kingdom of *Japan*, I remember also, *Pyrophilus*, that *Linschoten*, in his description of those Islands, tells us, That they drink Wine of Rice, wherewith they drink themselves drunk.

We have here in *England*, at the House of our experienced Mint-master, Dr. *Gordon*, tasted a Wine, which he made of that sort of Cherries which are commonly call'd *Morella*, that was, when we drank of it, about a year and a half old, but it was somewhat sower, and needed Sugar. And therefore I shall rather take notice to you of my having since drunk Wine made of the Juice of good, but not of extraordinary Kentish Cherries, which, with the help of a *Tantillum* of Sugar added in the Fermentation, kept so well, that though

it were above a Year old when I tasted it, I found it a strong and pleasant Wine, not inferiour to many Wines that are brought us from foreign parts. But this is nothing to what is averred upon his own experience, by a Learned Divine (to whom you, *Pyrophilus*; and I, am related) who affirms himself to have made out of some sort of wilde Apples and Pears, by bare Fermentation, such Liquors, as though at first somewhat harsh, will not onely keep divers years; but at the end of two or three, attain such strength, and so pleasingly pungent a taste, that they may compare even with choice out-landish Wines, and excell those that are not of the very best sorts of them.

Of excellent
Ciders.

But till we have in another Essay an opportunity of presenting you something out of the Observations of *Olearius*, the newly mentioned Divine, and our own, concerning Fermented Liquors, we shall content our selves to manifest our want of curiosity about the materials of which Drinks may be prepared, by this, That the Drinks of one whole Country are oftentimes unknown to the Inhabitants of another: That the Wine made of Rice, which we lately mentioned to be of frequent use in the Kingdoms of *China* and *Japan*, is of little or none in *Europe*, I need not prove to you. I have been in divers places where Beer and Ale, which are here the common Drinks, are greater rarities than the medicated Liquors sold only in Apothecaries Shops. In divers parts of *Muscovie*, and some other Northern Regions, the common Drink is *Hydromel*, made of Water fermented with Honey; And indeed, if a due proportion betwixt those two be observed, and the Fermentation be skilfully ordered, there may be that way, as experience hath assured us, prepared such a Liquor, both for clearness, strength, and wholesomeness, as few that have not tasted such a one, would readily believe.

Of Hydromel,

m

The

Of Sugar
Wines.

Lib. 4. cap. 1.

The French and English Inhabitants of the Canibal Islands, make, by Fermentation, a Wine of the dregs collected in the boiling of Sugar. A like to which *Piso* tells us, That they make in *Brasil*, and commonly call *Garapa*, which though made by the mixture of Water, the inhabitants are very greedy of; and when it is old, find it strong enough to make them Drunk. And how also in these colder Countrys a good Wine may be made of only Sugar and Water, we may elsewhere have occasion to teach you.

Lib. 4. cap. 6.

Of other Bra-
silian and Bar-
bada Wines.

And in *Brasil* they likewise, as the same Author informs us, make a Wine (unknown to most other Regions of the World) of the Fruit of *Acaju*, which yet, upon his experience, he much commends; telling us, That it is strong enough to inebriate, and may, he doubts not, be kept good many Years; and that though it be astringent, yet both in himself and others he found it diuretical.

In the *Barbada's* they have many Drinks unknown to us; such as are *Perino*, the Plantine drink, *Grippe*, *Punch*, and the rare Wine of Pines, by some commended more than the Poets do their *Vectar*, some of which we, therefore make not, because the Vegetables whereof they are produced, grow not in these colder Climates, But others also they have, which we have not, though they are made of Plants to be met with in our Soil; as for instance, the drink they call *Mobbie*, made of *Potato's* fermented with Water, which, being fit to drink in a very few days, and easie to make as strong almost as the maker pleaseth, would be of excellent use, if it were but as wholesome as it is accounted pleasant.

In the *Turkish* Dominions, where Wine, properly so called, is forbidden by *Mahomet's* Law, the Jews and Christians keep in their Taverns, a Vinous Liquor made of fermented

ed Raisons, after a manner, which (when we shall elsewhere acquaint you with it) you will easily discern to be capable of much improvement from the knowledge of Fermentation. And indeed by the bare fermenting of Raisons and Water, in a due proportion, without the helpe of Barne, Leaven, Tartar, or other additament to set them a working, we have divers times, in a few dayes, prepared a good Vinous Liquor which having for tryals sake distilled, it afforded us greater store than we expected, of inflammable Spirit, like that of other Wine.

The way to
make Wine of
Raisons.

But I have sometimes wondred that Men had no more curiosity to try what Drinkes may be made of the Juices obtainable, by wounding or cutting off the parts of severall Trees, and some other Vegetables: For that in the *East Indies*, their *Sura* is made of the Liquor dropping from their wounded *Coco* Trees, we have not long since out of *Linscoten* informed you. And sober Eye witnesses have assured us, That in those Countries they have but too often seen the Sea-men drunk, by the use of Liquors weeping out of the Incisions of wounded Vegetables, and afterwards fermented.

Of Wines from
the dropping or
weeping of
wounded Ve-
getables.

And that even in *Europe*, the Alimentall Liquor, drawne by Trees from the Earth, may receive great alterations from them before it be quite assimilated by them, may be gathered from the practice of the *Calabrians* and *Apulians*; who, betwixt *March* and *November*, do by Incisions obtaine from the common Ash tree, and the *Ornus* (which many Botanists would have to be but a wild Ash) a sweet Juice, so like to the Manna; adhering in that Season to the Leaves of those kind of Trees, that the Natives call it in their Language, *Manna del corpo*, or *Trunk manna*; and lest we should think they draw all this sweetness from the Soil of that particular part of *Italy* where they grow, you may be satisfied by the

Learned *Chrysostomus Magnenus*, in his Treatise *De Manna*, that it is to be met with in several other places. And he adds, That in the Dukedome of *Milane*, where he professeth Physick, there is no other Manna used than that which is (as he speaks) *Vel à trunco expressum* (which he somewhere calls *Manna Truncinum*) *aut in ramis stirratim concretum*; and that yet it is safely and prosperously used.

De Manna
cap. 18.

Of the tears of
the Walnut-
trees.

I had communicated to me, as a rarity, a secret of the King of *Polands*, which is said to do wonders in many Diseases, and consists only in the use of the Liquor which drops about the begining of the Spring, from the bar'd and wounded Roots of the Walnut-tree: but because I have not yet made tryal of it my self, I shall pass on to observe to you, that in some Northern Countries, and even in some parts of *England* bordering upon *Scotland*, the almost insipid Liquor that weeps in *March*, or the begining of *April*, out of the transversly wounded Branches (not Trunks) of the Birch-tree, is wont to be used by Persons of Quality as a preservative from the Stone; against which cruel Disease, *Helmont* highly extols a Drink made of this Liquor and *semen dauci* and *Beccabunga*, and I think not without cause. For not to mention all the commendations that have been given me of it by some that use it, I have seen such strange reliefe, frequently given among others, to a Kins-man of mine, to whom hardly any other Remedy (though he tryed a score imaginable variety) was able to give ease (and in whose distended Bladder, after another Disease and killed him, a Stone of many Ounces was found) that I usually every Spring take care to provide a quantity of this Water, with which alone, without the other Ingredients mentioned by *Helmont*, my Kins-man used to be relieved as long as he could keep it, which you may do the longer, by pouring upon the top of

The Use of the
tears of Birch
(with some o-
ther Ingredi-
ents) for the
Stone.

it a quantity of Sallet Oyl, to defend it from the Air; and perhaps also by Distillation: By which (last named) way, I know an Ingenious Man that is wont to preserve it for his own use, and sayes, he findes it not thereby impaired in vertue. But the most effectual way that ever I yet practised, *Pyrophilus*, to preserve both this and other Liquors and Juices, is dextrously and *sufficiently* to impregnate them with Fume of *Sulphur*, which must be at divers and *often* times as it were, incorporated with the Liquor by the due agitation; the manual Operation belonging to this Experiment, I may hereafter have occasion to discribe more fully, together with the particular Effects of it in severall Bodies. And therefore it may here suffice to tell you, that if you practise it carefully, you will, perhaps, think your self obliged to thank me for the discovery of it, though a heedful Reader may finde it, not obscurely, hinted in *Helmont's* Writings.

The wayes to
preserve these
Liquors.

I might here annex the great commendation which I have found given to this Birch water, by eminent Writers, against the hot distempers of the Liver, and divers other affections; and especially how *Freitagius* commends it very much to dilute Wine with: and addes, *Hac est dulcacidæ & grati saporis, sitim sedat viscerum & sanguinis fervorem temperat, obstructiones reserat, calculum pellit.*

The Use of
these tears of
Birch in hot
distempers of
the Liver and
hot Catarrhs.
In consilio Me-
dicinali in Ca-
tarrho calido pro
Principe quodam

But I suppose you will think it high time for me to proceed to another subject; and indeed I should not have spent so much time in discoursing of Drinks, but that I am apt to think, that if there were greater variety of them made, and if they were more skilfully ordered, they might, by refreshing the Spirits, and insensibly altering the mass of Blood, prevent and cure (without weakning or much troubling the Patient) almost as many Diseases as the use of our common, unwholsome and sophisticated Wines is wont to produce.

The Use of
Daucus Ale,
and proportion
of the seed to
the liquor.

For in Fermentation, the Sulphureous (as Chymists call them) the Active, and the Spirituous parts of the Vegetables, are much better loosened, and more intirely separated from the grosser and clogging parts, in most Mixts, than they are by the vulgar ways of Distillation, wherein the Concrete is not opened by previous Fermentation. And these nobler parts being incorporated with our Aliments, are with them received freely, and without resistance carryed into the Mass of the Blood, and therewith, by circulation, conveyed to the whole Body where their Operation is requisite. And I remember, that discoursing one day with an eminently learned and experienced Physician, of the Antinephritical virtue of our common wilde Carret-seed, fermented in small Ale; he smilingly told me, that he found its efficacy but too great; For having prescrib'd it to some of his rich Patients, who were wont frequently to have recourse to him in their Nephritical distempers, after the use of this drink for a pretty while, he seldome heard of them any more. And for your encouragement, *Pyrophilus*, to make tryals of this nature, we will adde, That though the Seed it self be not over well tasted, yet being fermented in a due proportion with the Liquor (we used an Ounce and half of the Seed, to a Gallon of the Ale) the Drink composed of both tasted pleasantly, almost like Lemmon-beer.

And that you may the less wonder at the efficacy of fermented Liquors, it is worth considering, what virtue is ascribed to the bare decoction of that Herb, which the *French* and we call *Thé*, or *Té*, which is much magnified here; and as far as my little experience in my self, and others (of which more hereafter) reaches, not altogether without cause: But among the *Chineses* and the *Japonians*, it is the common Drink of Persons of Quality, by whom it is so highly praised,

that the experienced *Tulpius*, in the new Edition of his Observations, tells us, That one pound of the Japonical *T'chia* (as the Natives call it) is not unfrequently sold for one hundred pounds of Silver; which is not to be wondered at, if they justly ascribe to it, that in those Countries Men are not subject to the Stone, or the Gout, and if but one half of the Virtues he there attributes to it, be for the most part to be found in it.

Of Animal
Drinks.

I might, when I told you of the variety of Materials not used among us, have added one strange Drink, which a Chyrurgion, that a while since lived at *Indies*, told me, he saw much used thereabouts: They make it of the raw Flesh of Goats, Capons, and the like, which together with Rice and *Molossos* (or black course Sugar) they put into a quantity of Water and distill it in an Alimbeck till the Liquor be stronger than Brandy (as they call common weak Spirit of Wine, or of Lees of Vinous Liquors). And this *Rack* (as the extravagant Liquor is called) is often drunk in hot weather, and found very comfortable: those that use it, prizing it much, as supposing it draws a nutritive and cherishing vertue from the Flesh, as indeed, if any quantity of the nobler parts of that, do concur to the constituting of the Liquor, it may probably be, at least to divers Bodies, very wholesome in that Country, where they finde strong Drinks necessary to recruit their Spirits, exhausted by the excessive heat of the Climate. As I remember, the experienced *Bontius* in his *Medicina Indorum*, tells us, That the Merchants travelling through the scorching Deserts of *Arabia*, *Persia*, or *Turkey*, finde it best to quench their thirst by a draught of the Spirit of wine, or else of the strongest *Persian* or *Spanish* Wine.

The Use of
Brandy Wine*
in hot Cli-
or mates.

And of the great use, if not necessity of either Brandy,

or such other strong and Spirituous Drinks in the hot Climate of the *Indies*, divers intelligent Persons of our own Country, have, upon their own experience. sufficiently satisfied us.

Nor, *Pyrophilus*, is Natural Philosophy able only to improve our Drinks, but the rest of our Aliments also: For not to mention, that Experience hath assured us, that by skilfully contriv'd Ovens (wherein the heat playes every way about the Bread, without yet suffering any of the smoak or steams of the Fire to come at it, and wherein what degree of heat you please may be continu'd from first to last) better Bread may be bak'd, than in our common Ovens, where the Bread rests upon the Hearth, and the heat is continually decaying. Not to mention this, I say, Physiologie can enable us to confer a very grateful taste on very many of the things we eat, barely by a skilfull and moderate untying and exciting the formerly clogg'd Spirits, and other sapid parts contained in them. It can teach us to make better Bread than is commonly eaten: And by discovering to us a better Art of Cookery, than *Apitius* and his successors have left us, and by substituting innocently sapid things, instead of those unwholesome ones, their deliciousnesse endears to Men; It can teach us to gratifie Mens Palates, without offending their healths: and in preserving of fresh Meats, Fruits, &c. beyound their wonted seasons of duration, the Naturallists skill may perform much more then you will readily believe.

And yet to incline you not to be too diffident in this particular, let me informe you, That much hath been already performed, as to the preservation of Aliments, even by those that have not troubled themselves to make Philosophical enquiries after the Causes and Remedies of Putrefaction in Bodies, but only have been taught by obvious and daily Observations, that the Air doth much contribute to the corruption of

The Use of
Natural Philosophy to meliorate Meats.

of some Bodies, and the exclusion of the Air to the hindring it. I remember, the inquisitive and Learned Mr. *Borreel*, assured me some while since, That he had in his Countrey, *Holland*, eaten Bisket that was yet good, after it had been carried from *Amsterdam* to the *East-Indies*, and brought back thence again (in which Voiage, between two and three Years are wont to be spent.) And to confirm my conjecture of the way of preserving this Bread so long, he told me, That the curious Merchant, whose it was, used no other Art, than the stowing his Bisket, well baked, in Casks exactly calked; and besides, carefully lin'd with Tin, for the more perfect exclusion of the Air. Adding, That to the same end the Biskets were so placed, as to leave as little room as possibly might be in the Cask, which also was not opened, but in case of absolute necessity, and then presently and carefully closed again.

Of preserving
Bisket from pu-
trefaction.

I may elsewhere tell you of an eminent Naturalist, a friend of yours and mine, that hath a strange way of preserving Fruits, whereby even Goof-berries have been kept for many Moneths, without the addition of Sugar, Salt, or other tangible Bodies; but all that I dare yet tell you, is, That he assures me his Secret consists in a new and artificial way of keeping them from the Air.

Of preserving
Fruits.

But it seems more difficult, as well as more useful, to be able to preserve Meat long without Salt; for tis sufficiently known to Navigators, how frequently, in long Voyages, the Scurvy, and other Diseases, are contracted by the want of fresh Meat, and the necessity of feeding constantly upon none but strongly powdred Flesh, or salted Fish; and therefore, he is much to be commended that hath first devised the way to keep Flesh sweet, without the help of those fretting Salts Men are wont to use to make it keep. This way is not un-

Of preserving
Meats wasted
for long Voya-
ges.

known to some ingenious Persons in *London*. One of the most noted of whom, upon my conjecturing how it may be performed, confessed to me, that I had hit upon the way in general. But the most satisfactory account I could get of it was from an English-man, that lately practised Physick in the *East-Indies*, who, finding I was no Stranger to what I asked him about, told me freely, that he had seen both Goats-flesh, and Hens, so well preserved by this way, that though it were put up in the *East-Indies* a while before he came thence yet he eat of it, and found it good and wholesome between the Islands of *Cape Verd*, (as the Seamen call them) and *England*; so that this Meat continued sweet above six Moneths, notwithstanding the heat and closeness of the Ship, the excessive Heat they met with in their passage under the Line, and consequently through the Torrid Zone, and that the way was onely this, That the Meat being well roasted, and cut in pieces, was carefully and conveniently ranged in a very close Caske, into which, afterwards, there was poured as much Butter melted, skimmed, and decanted from the grosser and ranker parts, as would fill up all the Intervals left between the several pieces of flesh, and swim about them all, and thereby keep out the Air from approaching them; and then the Cask being exactly closed, was stowed up in a convenient place in the Ship, and kept unopened till the Meat was to be eaten. And it must not be omitted, that the Relator, and others that had the care of making Provision for the Voyage, were fain, in stead of Butter made of Cows-Milk (which could not be had where they took in their Lading) to make use of that made of Goats, or Ews-Milk, which is not (as the *Indians* make it) so good, and to whose rankness he ascribed that which he had observed in some of the Meat buried in it, which he thought might have been preserved longer, and

and better tasted (for *wholsom* and *incorrupt* he said it was) in our *European* Butter, whose power to preserve Meat buried in it, after due Cōction, hath been confirmed to me upon their own observation, by an experienc'd Officer of the English Fleet, that had the oversight of the Provisions, and by others that had opportunity to observe it.

But how much the Naturalist's skill may advance the Dietetical part of Physick, by enabling men to make Aliments much lasting than naturally they are, I must not here labour to convince you by other Instances, that I may not anticipate what we have elsewhere to acquaint you with, from other Mens Experiments, and our own, about the conservation of Bodies. Onely I shall at present tell You in general, That I hope there will be wayes found out to preserve even raw Flesh it self (for of the keeping of roasted, we have just now given you an Instance) with things that do not so much fret it, nor give it so corrosive a quality, when eaten, as our common Salt doth. For not to mention what several curious Persons have practised, of salting Neats-Tongues with Salt-petre, which though done onely to make them look red, shews, that a Body, not corrosive like common Salt, may preserve Flesh; I have, for Trial sake, kept an entire Puppy of a pretty bignesse, untainted for many Weeks, (and that in the midst of Summer) and that without flaying, drying (by Fire, or otherwise) or so much as exenterating him, or cleansing him, or doing any thing towards the preserving of him, save the keeping him immersed in a well stop't Vessel, under Spirit of Wine (from whose Taste, I presume, Meat may be easily freed by Water) and there seemed small cause to doubt, that the onely thing that hindred me from keeping him much longer, was the want of time to pursue the Experiment, and take notice of its success. For I remember, I have the same

Of preserving
raw meats.

Salting Neats-
Tongues with
Salt-petre.

Of preserving
Flesh in spirit
of Wine.

way kept a soft substance, taken raw from an Oxe or Cow, for many Moneths (if I mistake not, eighteen or twenty) and found no putrefaction or ill scent in the immersed substance, which, for ought I know, might have been preserved divers Years together the same way, or at least, by an easie improvement of this method, of which, as I lately intimated, I intend You hereafter an account.

Of conserving
by Sugar, and
making Sugar
of other Con-
cretes besides
the Cane.

And I shall further adde on this occasion, That if we reflect upon *Sugar*, which is (at least in these Western Regions) but an almost recent discovery, and consider how many Bodies are with it, by Confectioners and others, not only preserved, but rendred exceeding grateful to the Taste; that single Instance may suffice to make us think it probable, that Expedients yet unthought of, may, by an insight into Nature, be found out, for the preservation of Bodies; especially, if our ingenious Friend Mr. *W.* would shew us, how out of divers other Concretes, besides the Sugar Cane, a Substance not unlike Sugar (though of different Taste, according to the nature of the Vegetable, that affords it) may, by a peculiar industry, be prepared: which, that you may not

* *Linschoten's Voyage, chap. 56.*—

When they desire to have no *Cocus*, or fruit thereof (namely, of the Palm-trees,) they cut the Blossoms of the *Cocus* away, and bind a round Pot, with a narrow mouth (by them called *Calao*) fast to the Tree, and then stop the same close round about with pot-earth, so that neither Wind nor Air can enter in, or come forth; and in that sort, the Pot, in short space, is full of Water, which they call *Sura*, and is very pleasant Drink, like sweet Whey, and somewhat better.

think unfeazable, let me mention to You (for perhaps he hath not yet taken notice of it) what even *Indians* have done of this nature. And first, let me inform You of what we are told by *Linschoten* * concerning that Drink, which in the *East-Indies* they call *Sura*, and made of the Liquor dropping from the Blossoms, that they cut away from the *Indian Palm-Tree*, which bears the

Coco Nut. For this *Sura*, he tells us, That amongst other things, they make Sugar (which is called *Fagra*) which is made

made by boiling that Liquor, and setting it in the Sun where it congeles to Sugar.

And though I must not conceal from you, that our Author adds, that it is not much esteemed by reason of its brown colour, and for that (to use his words) they have so great quantity and abundance of white Sugar throughout all *India*, yet the latter reason, of the cheapness of *Fagra*, seems to be the principal. For probably, if other Sugars were scarce, the melioration of this would be attempted; and tis very likely, That if a skilful Naturalist had the ordering of that sweet Juice, of which the *Indians* make their *Fagra*, he might very well make of it a Sugar of no small use; and such a Sugar would be very convenient in many cases, and to many Persons, for its being different from the common Sugar, though it should not be better. *Garcilassus* also (a much applauded Writer concerning the *West-Indies*) treating of the Fruits of a *Peruvian* Tree, called by some *Molle*, and by others *Mulli*, *Conficiunt* (saith he) *ex eo potum confricando blandè inter manus in Aqua calida, donec dulcor omnis defricetur. Percolant hanc Aquam servantq; dies tres quatuorve, donec subsideat; potus est limpidissimus, &c. Aqua eadem cocta convertitur in optimum mel.* And of the same Plant *Petrus de Cieca* hath this confirming Passage: *Ex hujus fructu cum Aqua decocto, pro coctura modo fit aut vinum sive potio admodum bona, aut acetum, aut mel.* And that there is a great affinity betwixt such Vegetable Honeys and Sugar, especially if the juices be ordered with a design of turning them rather into Sugar than Honey, You may easily gather from the next and more memorable instance which we are to mention, and which is afforded us by the diligent Describer of the *Brasilian* Plants, who treating of the *Caraguata*, or *Erva Babosa* (or as some would have it, *Herba innominata caule portulacæ*, hath these words

*Apud Jobi. de
Last. descr. Ind.
dia, l. 10. c. 3.*

*Apud eundem
eodem loco.*

words to our present purpose: *Porro* (saith he) *radendo ut vacula petrosa stolones, emanat ex concavitate liquor quidam tantâ copiâ ut ex una solummodo planta (mirabile dictu) interdum 50 aut plures aroba effluent, à quo liquore fit vinum, acetum, mel, & saccharum: liquor quippe perdulcis coquendo redditur multo suavior & spissior, ita ut tandem in saccharum congelescat.*

Since the writing of these last Lines, being visited by an ancient *Virtuoso*, Governour to a considerable Colony in the Northern *America*, and inquiring of him, among other particularities touching his Countrey, something in relation to the thoughts I had about the making of several kinds of Sugar, he assured me, upon his own Experience, that there is in some parts of *New England*, a kind of Tree, so like our Walnut-trees, that it is there so called; whose juice, that weeps out of its Incision, &c. if it be permitted slowly to exhale away the superfluous moisture, doth congeal into a sweet and saccharine substance: and the like was confirmed to me, upon his own knowledge, by the Agent of the great and populous Colony of the *Masathusets*. And very lately demanding of a very eminent and skillful Planter, why, living in a part of *America*, too cold to bear Sugar-Canes, he did not try to make Sugar of that very sweet Liquor, which the Stalks of *Maiz*, by many called *Indian-Wheat*, affords, when their juice is expressed? he promised me he would make Trial of it: Adding, That he should do it very hopefully, because that though he had never been solicitous to bring this juice into a Saccharine form, yet having several times, for Trial sake, boyld it up to a Syrup, and employed it to sweeten Tarts, and other Things, the Guests could not perceive that they were otherwise sweetned than with Sugar. And he further

further added, That both he and others had, in *New-England*, made such a Syrup with the Juice of Water-Melons.

Nor, *Pyrophilus*, is it onely by teaching Men to improve the wholsomnesse and taste of the Aliments, or to keep them long uncorrupted, that the Naturalist may contribute to the preservation of Man's health; for from the ingenious Attempts of *Sanctorius*, in his *Medicina Statica*, we may be invited to hope, that there may be wayes, as yet unthought of, to investigate the wholsomnesse or insalubrity of Aliments: as he, by the weight of Bodies, after having fed on such and such Meats, finds that Swines flesh, Melons, and some other things that he names (in the third Section) do much hinder insensible Perspiration, and consequently are unwholsome; though, as I take it, it were not amisse, that before such Observations be framed into general and established Aphorismes, they were carefully made in bodies of differing Ages, Sexes, and Complexions, and with variety of Circumstances. But then again, presuming these Maximes to be judiciously framed, the same *Statica Medicina* makes it hopeful, that there may be unthought of Methods found, whereby, by wayes different from those formerly used by Physicians, a Man may be much assisted in the whole manner of ordering himself, so as to preserve Health, and to foresee and prevent the approach of many Distempers. And perhaps by such unthought of wayes, divers Paradoxes of concernment to Man's health may be made out, as the diligent *Sanctorius* to that Observation proposed in these words, *Semel aut bis in mense facto excessu in cibo & potu, die sequenti, licet sensibiliter non evacuet, minus solito perpendit annexus* (in the following Aphorisme) addeth this important Corollary: *Vitæ uniformis caret beneficio illorum qui semel vel bis in mense excedunt.*

That the Naturalist may find out new wayes to investigate the wholsomnesse or insalubrity of Aliments, proved by instances out *Sanctorius* his *Medicina Statica*.

Sett. 3. Aph. 96.

The difference
in Transpirati-
on betwixt the
times after or-
dinary diet, and
after exerce, tri-
ed by the weigh-
ing of mans
Body.

Difference in
the weight of
Waters,

excedant: expulsi enim à copia irritata excitat tantum perspiratus, quantum sine statica nemo crederet. And indeed Experience hath informed us, that the promoting or suppressing of insensible Transpiration, by which, in a day, the Body may discharge it self of four or five pounds of Excrementitious Matter, hath a much greater power to advantage or prejudice Health, than is wont to be taken notice of; so that we see that the Staticks, which, though long known, were thought uselesse to Physick, may afford several important Directions in reference to the preservation of Man's health; to which there are likewise other wayes whereby the Naturalist may contribute. For he may also devise Means, whereby to judge of the Qualities of Aliments, especially Drinks in their respective kinds, and likewise of the Temperature of the Air in this or that place assigned: we shall, in one of the following Essayes, describe to You a small slight Instrument, by the help of which, one that is acquainted with this or that particular sort of Wine, may give a neer Guess whether it be embased with Water or not. And whereas in most hot Countries, where Water being the common Drink, is of great concernment to Man's health to be able to make a good Estimate of the salubrity of it; and whereas Physicians are wont to think Water *ceteris paribus*, the better and purer the lighter it is, this Instrument presently manifests, without any trouble of weighing in Scales, what among any Waters proposed is the heaviest, and which the lightest, and what difference there is of Gravity betwixt them. And this disparity may sometimes be so Great, that I remember some of our English Navigators tell us, That upon bringing home a sort of Water out of *Africa* into *England*, they found by the common way of Ponderation, the *African* Water in the same bulk, to be about for Ounces in the pound lighter than the

the *English*. And as the thicknesse or lightnesse of Waters may be thus presently discerned by this *Hydrostatical* way, so tis possible, by some Chymical Experiments, easily enough to discover some other Qualities, wherein Waters, that are thought to be of the same nature, differ from each other; as we find that very many Pump-waters will not beear Soap, as Rain-waters, and the generality of Spring-waters will do: some Water will not dye Scarlet, or some other particular Colour, because they are secretly imbued with some kind of saline Substance, that hath an Operation it should not have upon the Ingredients employed by the Dyer. And I have sometimes discovered a latent Sea-salt in Water, where others suspected no such matter, by pouring into it a solution of good Silver, made in *Aqua fortis*. For as common Salt, as well as the spirit of it, will precipitate the Metal out of such a Solution, in the forme of white Calx; so it seemed rational to conceive, that in case the Water I suspected had been imbued in its passage through the Earth with a saline quality, though not conspicuous enough to be taken notice of by the Taste, these Saline Corpuscles diffused through the Water, would, though faintly, act their parts upon the dissolved Silver; and accordingly I found, that upon the mixtures of such Waters, and the Metalline solution, there would immediately be produced a kind of Whitenesse (from some parts of the Metal precipitated by the Salt:) to avoid which, I have often been fain to use, in places where I met with such Waters, either Rain-water, or that which is freed from its common Salt, by a slow Distillation.

That Chymical Experiments may discover other qualities in Waters.

And as for the temperature of the Air, which is acknowledged to be of exceeding great Consequence, both as to health, and as to the prolongation of Life, and which is possibly yet of greater moment to both than most men imagine,

o

the

That the Naturalist may discover the qualities of particular Airs.

the skillful Naturalist's sagacity, if it were employed to that purpose, might probably find divers wayes of discovering the qualities, and consequently the salubrity and unhealthfulness of the Air in particular places. For the diligent *Sanctorius* (in the second Section of his *Medicina Statica*) teacheth us how to estimate the healthfulness and insalubrity of the Air, by the weight of those Mens bodies that live in it. And besides this (nice) way, we see, that by the late invention of Weather-Glasses, 'tis easie to discern which of two Neighbouring House, and which of two rooms in the same house is the colder. And I remember I have sometimes bethought my self of a slight way (to be mentioned in one of the following Essayes) by the help of which it is not hard to determine, in which of two places proposed, the Air is, *ceteris paribus*, the dryer or the moister; and to give also some Guess, both how much at the same time the Air of one place exceeds that of the other, and how the temperature of the Air changeth in the same place at several times, either of those qualities. And that the differing operations of several Airs, upon certain sorts of Flesh hung in them, upon some fading colours, upon Bodies subject to gather Rust, or to be tarnish'd, and in a word upon divers other subjects, may be more considerable, than Men seem yet to have taken notice of, I shall think it sufficient to have intimated in this place, being desirous to hasten to the following Essay, (wherewith I am to conclude, what I have to offer to You concerning Physick) that I may have the more time to employ on it.



- ESSAY V.

Presenting some Particulars wherein Natural Philosophy may be useful to the Therapeutical part of Physick.

ANd now, *Pyrophilus*, the method that we formerly prescribed to our selves (a little after the beginning of the first Essay) requires, that we consider a while the *Therapeutical* part of Physick, which is indeed that, whose improvement would be the most beneficial to Mankind; and therefore I cannot here forbear to wish, That divers Learned Physicians were more concerned, than they seem to be, to advance the Curative part of their Profession; without which, three at least of the four others may prove indeed *delightful and beneficial* to the Physician, but will be of very little use to the Patient, whose *relief* is yet the principal end of Physick, whereunto the *Physiological, Pathological, and Semetotical* parts of that Art ought to be referred. There was a while since a witty Doctor, who being asked by an Acquaintance of mine (himself an eminent Physician, and who related this unto me) why he would not give such a Patient more *Generous remedies*, seeing he grew so much worse under the use of those *common Languid ones*, to which he had been confin'd, that he could not at the last but dye with them

The Introduction.

in his Mouth? briskly answered, *Let him dye if he will, so he dye, secundum artem.* I hope there are very few of this Man's temper, but it were to be wished, that there were fewer Learned Men that think a Physician hath done enough, when he hath Learnedly discoursed of the Seat and Nature of the Disease, foretold the Event of it, and methodically employed a company of safe, but languid Remedies, which he had often before found almost as unable to cure the Patient, as unlikely to kill him. For by such an unprofitable way of proceeding, to which some lazy or opinionated Practisers of Physick (I say some, for I mean not all) have, under pretence of its being safe, confined themselves, they have rendered their whole Profession too obnoxious to the Cavils of such Empericks, as he that (as the Lord Verulam reports) was wont to say, Your European Physicians are indeed Learned Men, but they know not the particular Cures of Diseases; and (unreverently enough) to compare our Physicians to Bishops, who had the Keys of *binding and loosing*, and nothing else. Which brings into my mind what Monsieur De Balsac relates (in his witty French Discourse, *of the Court*) of a Physician of *Millain*, that he knew at *Padua*, who being content with a possession of his Science, and, as he said, *the Enjoyment of the Truth*, did not onely not particularly enquire into the Cure of Diseases, but boasted, That he had killed a man with the fairest Method in the World: *E morto* (said he) *canonicamente, e con tutti gli ordini.* And such Scoffs and Stories are readily enough entertained by the major part of Men, who send for Physicians, not so much to know what ailes them, as to be eased of it, and had not rather be methodically killed, than Empirically cured. And it doth indeed a little lessen even my esteem of the great *Hippocrates's* skill, to find mentioned in his Writings so many of his Patients,

tients, of whom he concludes, that they dyed. And I had much rather, that the Physician of any Friend of mine, should keep his Patient by powerful Medicines from dying, than tell me punctually when he shall dye, or shew me in the opened Carcass why it may be supposed he lived no longer. But, *Pyrophilus*, my Concern for Mankind, and for the reputation of many excellent Physicians, whose Profession suffers much by the want of either Industry or Charity, in such as we have been speaking of, hath diverted me longer than I thought, from telling You, That I suppose it will be not very difficult to perswade You, that this so useful *Therapeutical* part of Physick is also capable of being much improved by a knowing Naturalist, especially if he be an intelligent and expert Chymist, as in this Essay we will suppose him.

CHAP. L

SOME *Paracelsian* would, perhaps, seth forth, how much more easie to be taken Chymically-prepared Medicines are wont to be, than those loathsome and clogging *Galenical* Potions, *Bolus's*, &c. which are not only odious to the Takers, but (which is much worse) are to many so offensive; that either the Patients cannot get them down, or the incensed Stomach returns them by Vomit, before they have stayed long enough in the Body to do any more than distemper it. But I shall not much insist on this, because I think Wholsomnes to be much more considerable in a Remedy than Pleasantness: though, I confesse, I could wish that Physicians were more careful to keep Patients from being almost as much troubled by Physick, as by the Disease; and to cure, according to the old Prescription, not onely *cito* and *tuto*, but *jucunde* too: Especially

That the naturalist may invent Medicines Chymically prepared, more pleasant than the ordinary *Galenical* ones.

An instance in
Resin of *Falap*,
Mineral waters,
& the Author's
Pili Lunares.

Especially considering that, as we were saying, the loathsomeness of some Medicines maketh the Stomach reject them, before they can have performed their operations. And it is, I presume, on this account as much as any other, that at *Oxford* Learned and Practical Physicians, of your Acquaintance, make very frequent use (on Patients not Feaverish) of the resin of *Falap*, barely drawn with Spirit of Wine; since, as we have tryed, six, eight, or ten, or more Grains, of this almost insipid Resin, being cleanly prepared, according to Art, and with a little *Gum-tragacanth*, and half its weight of powdered Cinamon, or some such thing made up, may be taken in the Morning in form of Pills, instead of a Potion; and is wont to evacuate plentifully enough, and yet gripe the Patient much lesse than common Purges. But, as I said, I shall not insist on this. I might better commend the Usefulness of Chymistry to the *Therapeutical* part of Physick, from hence, That it is probable, that even emptying Medicines may, by the *Spagyrist's* Art, be so prepared, as not onely to be less offensive than common Purges or Vomits in the taking, but to be less painful in the working: As I have often observed, both in my self and others, that upon the taking of the clear, and not loathsome Mineral Waters of *Barnet*, though the Medicine wrought with me ten or twelve times in a morning, yet it did neither pain me, or make me sick, or disorder me for the remaining part of the day, any thing near so much as a common Pill or Potion that had wrought but once or twice would have done. And I shall elsewhere (God permitting) teach You a preparation of Silver, whereof about three or four Grains being made up (with any proper Conserve) into a little Pill, is wont to make a copious evacuation of Serum especially (in Bodies that abound with it) without making the Patient almost at all sick, or Griping him: Insomuch that

I know some persons, both Physicians and others, with whom though this Medicine work frequently in a day, and though (which is stranger) once taking of it will with some persons work so for two or three, or more dayes successively, yet they scruple not to goe abroad and follow their businesse, and some that take it, tell me, That when it works not with them, as for the most part, when it hath freed the Body from superfluous *Serum*, it will cease, and in some Bodies will scarce purge at all, it neither puts them to pain, nor makes them sick.

And now I am speaking of the painlesse wayes of relieving the sick, I shall adde, That there is another way, whereby tis to be hoped, many Patients may be rescued from a great deale of paine; and that is, by finding out Medicaments, that may in several Distempers, that are thought to belong peculiarly to the Chyrurgion's hand, excuse the need of Burning, Cutting, Trepanning, and other as well painful as terrible manual Operations of Chyrurgery. *Helmont* tells us, That he knew a Countrey-fellow, who cured all fresh Wounds by a Drink, made (as I remember) of burnt *Tilia*. I have informed You in another Essay, of the Cure I observed to be made of the exulcerated *Tumors* of one sick of the *Kings-Evill*, by the use of Beer, altered by a little Plant, that did not at all disturb the Taker. If we may believe *Helmont's* and *Paracelsus's Præcipitatus Diaphoreticus*, taken at the Mouth, doth cure, to use his own Words, *Carcinoma, Lupum, & quodlibet Aethiomenum cacoethes ulcus, sive externum sive internum*. And if there be any truth in what hath been affirmed to me by several Eye-witnesses, as well Physicians as others, concerning the *Weapon-salve*, and *Powder of Sympathy*, we may well conclude, That Nature may perform divers Cures, for which the help of Chirurgery

That the Naturalist may find out inward Medicines able to do Chirurgical Cures, proved by divers Instances.

Helmont de Febribus c. 14.
See also the same Author in *Tract. quem vocat Arcana Paracelsi. Et lib. de Febr. c. 14.*

gery is wont to be implored, with much lesse pain to the Patient, than the Chirurgion is wont to put him to. I know a very ingenious man, that is Famous as well for his Writings as for a Remedy, wherewith he undertaketh to cure constantly the exulcerated Cancers of Womens Breasts, without any considerable pain: But having not yet had opportunity to make tryal of that which I have lying by me, I shall onely tell You he assures me, That this Medicine is indolent, and mortifies the ulcerous parts as far as they are corrupted, without disordering the party troubled with them; which I the lesse doubt, because, that (to adde thus much on this occasion) partly by the Colour, &c. of this Powder, and partly by his own Confession to me, it seems to be a dulcification of *Arsenick*, first fixt with *Nitre*, and then carefully freed from its corrosivenesse, by very frequent Distillations of fresh Spirit of Wine. I shall ere long have occasion to teach You a Drink, whereby exulcerated (but not Cancerous) Breasts have been very happily cured. The learned *Bartholinus*, in his late Observations, mentions the Cure of some hurts in the Head, done without Trepanning, in cases where that formidable and tedious Operation is wont to be thought necessary. As for the terrible way of stopping the violent bleeding in great Wounds, by seering the Orifices of the Vessels with hot Irons, it would be little needed, if we knew such Remedies, as that which the Inquisitive *Petrus de Osma*, in his Curious Letter to *Monardes* from *Peru*, mentions in this passage, which I find among his other Observations: *Ann* (saith he) 1558. *in urbe D. Jacobi, quæ est in Provincia Chyle, quidam Indi captivi suras sibi amputarunt, & eas assas præsente ederunt, & (quod mirabile dictu) cujusdam Planta folia vulneribus imponentes, illico sanguinem fistebant.* I knew a rich Man, extremely corpulent, who having long had a strange

Apud Monard.
de simplic. disc.
dis. pag. 84.

Kind

kind of *Fistula* in his Breast, and having travelled from one Countrey to another, to consult with the ablest Chirurgions, was at length brought to that passe, that at a Consult they resolved, by opening his Breast, to try if they could track the winding *Fistula*, and save his Life: And as the Instruments, for this sad operation, lay upon the Table, another famous Chirurgeon casually coming into the House, told the Patient that he had an art of curing *Fistulas* without cutting them open, and without any considerable pain or trouble: whereupon the rich Man offering him what he pleased for the Cure, the Chirurgeon quickly performed his promise, as the patient himself, who shewed me his Breast, confessed to me, and that by the use of an almost indolent Remedy, which he purchased of the Chirurgeon, and which by his favour came to my hands: And that even very ill-condition'd *Fistulas* may be cured without Chirurgical Operations, by Medicines taken at the Mouth, I shall ere long have occasion to shew you by a notable Example.

In the mean time I shall adde, That a Man, whom I suppose you have often seen, having a while since received such a kick of a Horse, as made the Doctor and Chirurgeon that tended him, to conclude the part gangrenated, and the patients condition, by the accession of a violent Feaver, so desperate, that they desired to meddle with him no longer; a large Dosis of Sir *Walter Rawleighs* Cordial, sent him by an excellent Lady you are neerly related to, not onely freed him from his Feaver, and the *Delirium* that attended it, but, to the wonder of all that observed it, restored the Limb that was concluded gangrenated, to its former soundnesse.

And to bring credit to all these Relations, I shall crown them with that memorable passage of *Gulielmus Piso*, of as great things that he saw done by the illiterate *Indians* themselves

Sir W. Rawleighs
Cordial.

What great use
the Indians
make of the
Juice of To-
bacco.

selves: *Memini* (saies he) *in castris membra militum globulis sclopetorum icta, & jamjam ab Europæis Chirurgis, tam Lusitanis quam Batavis, amputanda, barbaros recentibus gummi succis & Balsamis à ferro & igne liberasse, & feliciter restituisse. Oculatus itidem testis sum in Nosocomiis relictâ ulcera & gangrenas ab illis vel solo succo Tabaci curata.*

But, *Pyrophilus*, That the making of divers Helps to Recovery lesse distastful, or lesse painful to the Patients, is not the only, nor perhaps the greatest service that Chymistry may do him that attempts the Cure of Diseases, I shall now endeavour to manifest in some particulars.

CHAP. II.

That the search
of Nature by
Chymistry in
particular discovers
the qualities of
Medicines.

AND first, The skilful Naturalist, especially if a good Chymist, may much assist the Physitian to discover the Qualities of Medicines: whether *Simple* or *Compound*; That the Experiments of the Spagyrist may much contribute to the examining those many things themselves (prepare, you will, I presume, easily grant: That also divets Mineral Waters are of the nobler sort of Medicines, is sufficiently confessed on all hands; and tis known too, that the industry of Chymists hath produced some good directions towards the discovery of the Minerals predominant in divers Medicinable Springs: But I am much mistaken, if they have not left much for others to do, which may be easily done. And I scarce doubt but that by the various wayes that might be proposed, of trying what such Waters hold, and what saline or other Qualities are predominant in them, not onely the nature of those Medicinal Waters that are already used, might be more thoroughly understood; but undetected properties might in many others that are now not taken notice of, be discovered,

of some of which wayes of examining Mineral Waters, I may elsewhere give you an intimation. And I have made several Tryals that have, I confesse, much inclined me to think, that the fault is rather in us, than either in Nature or Chymistry, that Men do not, by the help of Chymical Experiments, discover more of the nature of divers Medicaments, than hitherto they seem to have so much as aimed at: For though the abstruse endowments of Specificks will not, I fear, be learned in hast, otherwise than by particular Tryals and Observations; yet many Simples have other Qualities, which seem chiefly to reside, though not in an Elementary Salt or Sulphur, yet in a part of the Matter that seems of kin to a Salt or Sulphur: such as sowerness, saltness, a caustick or a healing faculty, abstersiveness, and the like, upon whose account such remedies seem chiefly to work in a multitude of cases. And towards the Investigation of such Qualities, a Chymist may oftentimes do much, without making all his tryals in humane Bodies. But though, to illustrate this matter, I have sometimes made several Experiments, yet not having now my Notes and observations at hand, I shall only mention a few things as they offer themselves to my memory, reserving the more distinct handling of this subject to another opportunity: And the rather, because that till such *Phænomena* have been more diligently observ'd, and reduced to their distinct sorts, I would have them looked upon but as hints to further Enquiries, not as sufficient Authority to ground general Rules on.

There are some Plants, whose Juices, especially when the superfluous moisture is exhaled or abstracted, will, (some by the assistance of a gentle Heat and Filtration, and some, even of themselves, in time which I remember hath in some succulent Plants amounted but to a very few hours) coagulate

Of the Nitro-
Tartareous Salt
in some Vege-
tables.

in part into a kind of Salt, which, if you please, you may call Essential: And by this Nitro-Tartareous Salt (as it seems to be) those Vegetables, whose Juice affords it (such as are, if I mistake not their names, *Parietaria*, *Borrag*, *Bugloss*, &c.) may be discriminated from those many others, from whence it is not (at least by the same way) to be obtained. And possibly also these Salts may, to a heedful Surveyor of them, appear to differ enough from each other in shape, taste, or other obvious Qualities, to deserve to be sorted into differing kinds.

If likewise we compare the Essential Salts and Spirits of these Plants, which those of *Scurvy-grasse*, *Brook-lime*, and other Vegetables that are counted *Antiscorbutical*, and abound in Volatile and Saline parts: And if we also examine other Plants, by divers Chymical Operations, and observe not only their disposedness or indisposition to yield Spirits or Oyls by Fermentation, or without it, but those other particulars wherein they will appear to agree with, or differ from each other: there is little doubt but such Tryals will make them discover, to a considering Naturalist, much of their Natures and Properties, and especially of such as depend chiefly upon the plenty or paucity of the saline, unctuous, sower, spirituous, lazy, tenacious or volatile parts.

Difference in
Operation be-
tween acid and
Alkalizate salts.

It may be also observed, that the Infusion or Decoction of some Plants, as of *Brazil*, *Senna*, &c. will be heightened into a reddish colour, by putting *Alkalizate* Salts, as of *Tartar*, or of Pot-ashes, in the Water that extracts their Tinctures: Whereas acid Spirits, at least some of them, will much impair, if not destroy their colour; as a little *Aqua fortis* will immediately turn a red Tincture of *Brazil*, made in fair Water, into a pale yellow: Whereas on the other side, I have observed, that a small quantity of a strong Solution of Pot-ashes

ashes, dropt into an Infusion of red-Rose leaves, hath presently turned it into a muddy colour, that seemed to partake of green and blew, but was dark and dirty; whereas a little *Aqua fortis*, or good Spirit of Salt poured into the same simple Solution, did immediately turne it into a fine red, and so it would do the muddy Mixture laetly mentioned, if it were put to it in a far greater quantity. I observed also, that with a very strong (though clear and well filtrated *Lixivium* of Pot-ashes, I could precipitate some part of the Infusion or Decoction of red-Roses, which grosser parts, when the Mixture was filtrated through Cap-paper, remained like a dirty colour'd (though somewhat greenish) Mud in the Filtre; the fluid and finer part of the Mixture passing through in the form of a Liquor high coloured, almost like *Muscadine*.

And on this occasion, I remember, that as Galls, a very stiptick Vegetable excrescence, will yield a Decoction, with which, and *Copperis*, the common Ink is made; so divers other Plants, of notably astringent parts, may be employed to the like use: For, by casting *Vitriol* into a Decoction either of Oaken Bark, or red-Roses, or even a bare Infusion of either Log-wood, or *Sumach*, to name now no other Plants of the like nature, I have presently made a Mixture that might make a shift to serve for Writing-Ink; but whether all stiptick plants or they onely, will with *Vitriol* make an Ink, I refer to further Enquiry: And as a Solution of *Vitriol*, and the Decoction of the above-mention'd Plants, do precipitate each other to make Ink; so I remember I have tryed, that by dissolving the Chrystals of pure Silver (made the common way with *Aqua fortis*, or Spirit of *Nitre*) in a good quantity of fair Water, that the Liquor having no colour of its own, the colours it produceth in other Bodies may be the better observed, I found that I could with this Liquor precipitate out

Of Ink made
by the decoction
of divers astringent
Plants, with a
little Vitriol,

Of some Metalline precipitations.

of the Infusions alone of several Vegetables, Substances differing in colour'd, according to their respective dispositions. And so I have found, with lesse cost, that *Saccharum Saturni*, which seems to be a kind of *Vitriol* of Lead, whilst it lies dissolved in the same Spirit of Vineger which extracted it from the Metal, being put to the bare infusion of Log-wood, *Lignum Nephriticum*, red roses (to name those I now remember I made tryal of) they will precipitate each other.

That Sulphurous Salts turn the expressed Juices of Vegetables into a green colour.

I might further adde, That I have tryed that sulphureous Salts, such as Oyl of Tartar, made *per Deliquium*, being dropt into the expressed Juices of diverse Vegetables, will in a moment, turn them into a lovely Green, though the Vegetables were of colours differing from that, and from one another (as I remember one of those Vegetables, in which I expected, and found that change, was of a fine Carnation) And I could tell you, that though it be disputed whether Quick-lime have any Salt dissoluble in Water, and of what sort it is, the *Examen* of that Question may be much furthered, by trying, as I have done, that the Water of Quick-Lime, well made, will precipitate a Solution of sublimate made in fair Water, and will presently turn Syrup of Violets (which is Blew) if well mixed with it, into a fair Green. Experiments I say of this nature I might easily annex, but having already set down divers of them in what I have written concerning Colours, I shall refer you thither: And now only adde this Observation, that the investigation of divers Medical Qualities, even of Animal Substances, may be as much assisted by the Naturalist, especially a Chymist; as we elsewhere have by the Distillation of the *Calculus humanus* shewn, how much it differs from the Stones that are found in the Earth. And if you take those hard Concretions, found at certain times in the Heads of Craw-Fishes, that are wont

Of the distillation of the *Calculus humanus*, and of the Concretions that are called *Lapides Canceryum*.

to be called *Lapides Cancrorum*, and commit some of them to Distillation, and infuse some in Vineger, and others in old Rhenish-wine, or strong White-wine, you will probably discover something of peculiar in the nature of this Concrete, of which I may possibly elsewhere make further mention to you: And not onely so, but in some Animal Substances, you may, by fit Experiments, discover notable Changes to be made, and their Qualities to be much heightened, when the Eye scarce perceiveth any Change at all, as I have purposely observed, in keeping Urine in close Glasses, and a moderate heat for many Weeks: For at the end of that time, the Virtues that depend upon its volatile Salt will be so heightened, that whereas upon putting Spirit of Salt to fresh Urine, the two Liquors readily and quietly mixed, dropping the same Spirit upon digested Urine, there would presently ensue a Hissing and Ebullition, and the volatile and acid Salts would, after a while, concoagulate into a third Substance, somewhat of the nature of *Sal Armoniack*. And whereas the Syrup of Violets, formerly mentioned, being dissolved in a litle fresh Urine, seem'd to be but diluted thereby, a few drops of the fermented Urine tempered with it, did presently turne into a deep Green: And the same digested Urine being dropped upon a Solution of Sublimate made in fair Water, presently turned it white, by precipitating the dissolved Mercury. With what (various) successse we have likewise made upon some other parts of a humane Body, as well consistent as fluid, some Tryals, analagous to what we have recited of Urine, I may *elsewhere* perchance take notice to you: But of such kind of Observations I must give you but this Hint at present.

The Changes in Animal Substances made by Fermentation only, particularly in Urine.

Of the mixture of Spirit of Salt with digested Urine.

CHAP. III.

That the search
of nature addes
much to the
Materia Medi-
ca.

S*Secondly:* By these and other wayes of investigating the Medical Qualities of Bodies, the Naturalist may be enabled to adde much to the *Materia Medica*: and that two several wayes.

By employing
bodies hitherto
not imployed.

Of Remedies
newly prepared
out of *Zinck*.

The Cure of
the Drop sic by
the Pill *Luna-*
ria.

For he may by his several wayes of Tryal, and by his Chymical preparations discover, that divers Bodies, especially of a Mineral nature, that are as yet not at all imployed by Physicians, at least internally, may be brought into use by them; and that others that are naturally so dangerous, as to be used but in very few, and for the most part extreme cases, may with safety be more freely employed. Some Modern Chymists (as particularly *Glauberus*) have of late prepared Remedies not unuseful out of *Zinck* or *Spelter*: And I have already mentioned unto you an excellent Medical use of Silver, of which, prepared (as is there intimated) I have now this to adde, That since I began to write of it to you, I met with a considerable person, who assures me, That she her self was by the use of it in a short time, cured of the Dropsie, though, by reason of her having a Body very corpulent, and full of humours, she have been thought more than ordinarily in danger of that stubborn Disease. I have sometimes wondered, that there hath been so little care taken by Physicians, and even by Chymists, to investigate the Qualities of Mineral Earths, and those other resembling Bodies, that are, or may be plentifully enough digged up in most Countries, though not the self same in all, for however men are pleased to passe them slightly over, as if they were but Elementary Earth, a little stained, or otherwise lightly altered: I have seen great variety of them, that have been digged sometimes within

within the compasse of a little spot of Ground: and the differences of divers of them, both as to Colour, Taste, Consistence, and other Qualities; have been too great, not to make me suspect they were of very differing natures. And the true *Bolus Armenus*, and the *Terra Lemnia*, which is now brought us from the Island that gives it that name, (markt with a Seal, which makes many call it *Terra sigillata*, though that name be for the same reason applyed to the *Terra Silesiaca*, and other Medical Earths) have been so esteemed, both by Antient and Modern Physicians, as well against Malignant Diseases, and the Plague it self, as against divers other Distempers, that it is the more strange, that (since the greatest part of those two Earths, that are now brought into our Countries, have not, as the more skilful complain, the true marks of the genuine Earths, whose name they bear) Physicians have not been more careful to try whether their own Countries could not furnish them with the like, or as good, especially in regard some of the few attempts of that nature, that have of late times been made, may give them as much encouragement. For, not to believe the Boasts of the *Silesian Johannes Montanus* (who passeth for the Inventor of the *Terra sigillata Silesiaca Strigoniensis*) in the Writing he published of the virtues of it, That it is Gold prepared and transmuted, by provident Nature, into an admirable Medicine; I find that Learned Physicians prefer it before the *Lemnian* Earth, that is now brought from *Turky*. And the experienced *Sennertus* gives it this Commendation, *Experimentis* (saith he) *multis jam probatum est, ejus insignes esse vires contra pestem, febres malignas, venenatorum animalium morsus, diarrhoeam, dysenteriam*. What he addes, that the Chymists name it *Axungia Solis*, brings into my mind (what I shall hereafter have occasion to mention more particularly to you)

Of the use of
Medical earths.

*Epitome scientiæ
naturalis. l. 2. c. 8*

Instances of
Gold and divers
noble *Menstru-*
ums drawn out
of them.

that I had once brought me a certain Earth, by a Gentleman that digged it up in this, or some neighbouring Countrey, which though it seemed but a Mineral Earth, did really afford, to a very expert Trier of Metals of my acquaintance, a not despicable proportion of Gold. They have also found in *Hungary*, an Earth, which they call *Bolus Tockaviensis*, which is affirmed by *Crato* (in *Sennertus*) to melt in the Mouth like Butter, and to have all the other proofs of the true *Bolus Armenus*, and therefore is, by that judicious Physician, preferred before the Modern *Bolus Armony*, even that which was brought out of *Turky* to the Emperour himself, and he relates, not onely its having succeeded very well against *Catarrhs*, but his having experimentally found it of great efficacy in the plague, that reigned in his time at *Vienna*. To which I shall adde, That a very Learned and Successful English Doctor, now dead, did some Years since, during a great Plague that then raged in the City where he lived, find a vein of red Earth, not very far from that Town, and prescribed it with very good successe in pestilential Feavers, as I was informed by an Ingenious Friend of his, that used to administer it, and shewed me the place where he digged it.

I remember also, the experienced Chymist *Johannes Agricola*, in his Notes upon what *Poppus* delivers of *Terra Sigillata*, after having much commended the *Terra Silvestris* in divers Diseases, and equalled it to the best of *Turky*, where he had travelled, relates one strange thing of it, with many Circumstances, and in a way as if he spoke upon his own Trial, namely, That the Spirit of *Terra Sigillata*, by which I think he means the *Strigonienfis*, doth, though slowly, dissolve Gold as well as an *Aq. Regis*, and that into a red Solution; whence in two or three dayes the Gold will fall of itself into a very fine and subtile powder. And the same Au-
thor

thor tells us, That he hath seen another Earth digged at the *Rheinstran*, not far from *Westerwaldt*, which was more inclinable to white than to yellow, which is preferable to the *Silesian*, and gives more Salt than it. and dissolves Silver better than other *Menstruums*; since, as he saith, the Silver may thereby be easily made potable, and be prepared into a very useful Medicine for the Diseases of the Head. And for my part, I do not much wonder at the efficacy of these Earths, when I consider, that divers of them are probably imbued, as well as died, with Mineral Fumes, or tinged with Mineral Juices, wherein Metal or Minerals may lie, as the Chymists speak, *in solutis principiis*; in which form, having neither endured the fire, many of their usefulest parts are more loose and volatile, and divers of their virtues lesse locked up, and more disposed to be communicative of themselves, than they are wont to be in a more fixed or cogulated state, or when they have lost many of their finer parts by the violence of the Fire.

Besides, there are several Mineral Bodies, which though perhaps they may not be of themselves fit for the Physicians use, may, by addition of some other convenient Body, or by sequestration of the more noxious parts, or by some such other Chymical Preparation, as may alter the Texture of such Minerals, be rendred fit to increase the *Materia Medica*: As I have known, that by a preparation of *Arsenick*, with Salt-petre, whereby some of the more volatile and noxious parts are driven away, and the remaining Body somewhat fixed and corrected by the *Alkali* of the *Nitre*, it hath, by a farther dulcification with Spirit of Wine, or Vinegar, been prepared into a kind of *Balsamum fuliginis*, which wonderfully cured a Physician of my Acquaintance, as himselve

Of Medicines
out of Arsenick

confessed to me, of dangerous Venereal Ulcers (divers of which penetrated even to the *Meatus Urinarius*) which had reduced him to great Extremity.

And out of *Bismutum*.

Apud Schroederum in pharmacop. l. 3. c. 18.

Dr I. C.

And though *Bismutum* have not, that I know, till very lately, been used, unlesse outwardly, and especially for a Cosmetick (hereafter to be taught you,) yet the industrious Chymist, *Samuel Cloßens*, by Calcination, and addition of Spirit of Vinegar, and *Cremor Tartari*, makes two Medicines of it, which he highly extols in the Dropfie; and (to reserve for another place, what I have tryed upon Tin Glasle) a very expert Chymist of my Acquaintance, doth, by preparing it with common Sublimate (carried up by which, I remember, it hath afforded a very prettily figured Body) make it into a white powder, like *Mercurius vita*, which he assures me he finds, in the Dose of a few Grains, to purge very gently, without being at all, as *Mercurius vita* is wont to prove violently enough, Emetick.

Of the correction of poisonous Medicines.

2. But the Naturalist may adde to the *Materia Medica*, not onely by investigating the qualities of unheeded Bodies, but also by gaining admittance for divers, that, though well enough known, are forbore to be used upon the account of their being of a Poisonous nature; for by digestion with powerful Menstruums, and some other skilful wayes of Preparation, the Philosophical Spagyrist may so correct divers noxious, nay poysonous Concretes, unfit in their crude simplicity for the Physician's use, at least in any considerable quantity, as to make them useful and effectual Remedies. *Helmont*, who, though frequently extravagant in his Theorie of Physick, doth often make no bad Estimate of the power of Remedies, after having told us, That he adored and admired the Clemency and Wisdom of God, for creating Poysons, gives this account of his so doing: *Nam venena* (saith he)

voluit

ne luit nobis esse venena aut nocua. Nec enim Mortem fecit, nec Medicamentum exterminii in terra: sed potius ut parvo nostri studio, mutarentur in grandia amoris sui pignora, in usuram mortalium, contra futurorum morborum savitiam. In illis nempe latitat subsidium, quod benigniora & familiaria Simplicia recusant aliàs. Add majores & heroicis medentum usus venena tam horrida servantur. And though I would not forbid You, *Pyrophilus*, to think there is some *Hyperbole* in the *Encomiums* he here and elsewhere gives poysonous *Simples*; yet when I consider, what great things are oftentimes performed by *Antimony*, *Mercury*, and *Opium*, even in those not over-skilful wayes of preparing them, that are divers of them vulgarly used by Chymists, especially when the preparations are (which doth seldom happen) rightly and faithfully made; I can scarce think it very unlikely, that those active *Simples* may, by a more skilful way of ordering and correcting them, be brought to afford us very noble Remedies. And the same Examples may in part prevent the main Objection that I can foresee in this case, which is, That whatever corrects Poysons, must, with their virulency, destroy their activity; for the above-named *Simples*, though so prepared as to be Medicines safe enough, have yet activity enough left them to let them be very operative, their Energy being, by preparation, not onely in part moderated, but in part so over-ruled, as to work after a more innocent manner: as in *Bezoardicum Minerale*, skilfully prepared, (for it very seldom is so) the Laxative and Emetick virulency of the *Antimony* is changed into a Diaphoretick, resolving, and deopplative power: which probably made the experienced *Riverius* (though counted a *Galenist*) so particularly recommend this Medicine to Physicians, which, if I be not mistaken, may well be praised without being flattered. And *Helmont* supplies

*Helmont. de phar-
mac. & dispens.
Moderna. num. 46*

Helmont. tract.
supra allegato.
num. 46, 47.

The preparati-
on of *Asarum*
turns it from be-
ing Emetick to
be notably Di-
uretical.

plies me with an Easie Experiment to our present purpose, by telling us, That *Asarum*, which when crude, doth, as is well known, provcke Vomits, by a slight preparation (presently to be mentioned) is so altered, that its Virulency is changed, to use his Expression, *in deoppilans, diureticum tar-
darum februm remedium*; which I the rather take notice of, because I find, upon enquiry purposely made of some Ingenious Physicians of my Acquaintance, that upon tryal, they commend this preparation of *Helmont's*, and confesse, that by it the *Asarum* loseth its Emetick, and acquires a Diuretical Quality.

Helmont. p. 466

Helmont. de Li-
thiasi. l. 7. c. 32.

Instances in
some of the se-
cret *Menstrua*
ums.

Now that all other Animal and Vegetable Poysons may be corrected, without losing their force with their Virulency, is the affirmation of *Helmont* concerning *Paracelsus's* and his *Sal Circulatum (majus)*. And as for Vegetables, he elsewhere tells us, That the *Lapis Cancrorum* resolved in form as he speaks, *pristina lactis, habet remedium contra incli-
mentias multorum vegetabilium vi laxante infamum*. And I remember that I knew two Physicians, the one of which affirmed to me, his having seen trial made (by the help of a noble *Menstruum*) of what *Helmont* here teacheth, and found it true; the other, a person severe, and apt enough to dissent from *Helmont*, assured me, That with the volatile Salt of *Tartar*, he had seen Vegetable Poysons, and particularly *Napellus*, so corrected by a light digestion with it, that it lost all its poysonous Qualities: for proof of which he freely offered me, to take himself as much of that fatal Herb as would kill three or four Men, (but at that time, and in that place, I could not get any of the Plant to make the Experiment with.) And though I shall say nothing now concerning *Helmont's Sal circulatum*, yet as to the volatilization of the Salt of *Tartar*, what I have seen scarce permits me to doubt, that

it is possible. And if I could now clearly acquaint you with my reasons, you would perchance, not wonder to find me inclinable to think, that some such methods (perhaps a *Menstruum*) may be found to correct poisonous Simples, without rendering them ineffectual. And though it must be some very powerful Corrective, whether Salt or Liquor, that shall be able to correct any store of differing Poysons; yet it is not irrational to think, that divers particular Concretes may be prepared without any such abstruse or general Corrective, some by one way of handling it, and some by another. And in such cases, Skill in the natures of particular Bodies to be managed, or lucky Hits, may supply the place of a meliorating Dissolvent, of which *Helmont* affords me a considerable Instance, where he teacheth, in the place lately quoted, That the Emetick property of *Asarum* may be taken away, and the Plant turned into a noble Diuretick, onely by boyling it a while in common Water. And whereas a wary man would be apt to suspect, that this change is made but by the avolation of some subtle parts, driven away by the heat of the boiling Water, I find that our Author affirms, that though it be boyled with the like degree of Fire, in Wine, instead of Water, it will not so lose its violence. I have known white *Hellebor*, *Opium*, and some other noxious Bodies, so prepared, as to be given not onely harmlesly, but successfully in such quantities, as were they not skilfully corrected, would make them pernicious. We daily see, that the violent Emetick and Cathartick properties of *Antimony*, may singly, by calcination with *Salt-petre*, be destroyed. And (which is though a known, yet a notable Experiment among Chymists) *Mercury* sublimate may be deprived of its deadly corrosivenesse, and prepared into a Medicine inoffensive even to Children, by bare Resublimations with fresh *Mercury*. And to give

That the proportion of *Asarum* is onely the boyling it in common water. *Helm. in pharmacop. & dispensa Modern. N. 46, 47.*

That the boiling in Wine alters not its violence.

That the Emetick & Cathartick properties of *Antimony* are destroy'd by calcination with *Salt-petre*, and *Mercury* sublimate be deprived of its Corrosivenesse by bare resublimations with fresh *Mercury*.

A strange correction of the
the flowers of
Antimony.

give You one instance more of what the knowledge of the effects of Chymical Operations, and of the disposition of a particular Body, may enable a man to do, in changing the pernicious nature of it; I shall adde, that the violently vomitive Flowers of *Antimony*, which our wonted, though sumptuous and specious Cordials are so unable to tame, I can shew You (which perhaps You will think strange) so corrected, without the addition of any thing besides *heat* and *skill*, that in a treble Dose, to that wherein they are wont to be furiously Emetick, we have not found them to work otherwise than gently by Sweat. But some more Particulars applicable to our present purpose, you will meet with by and by.

CHAP. IV.

That the Naturalist may assist
the Physician to
make his Cures
lesse chargeable

THirdly, And now, *Pyrophilus*, that I am speaking of the service that the Naturalist may do Physick, I must not pretermitt, that he may assist the Physician to make his Cures lesse chargeable. For though to cure cheaply, be not properly, and in strictnesse, any part of the end of the Art of Physick, which considers mens Health, and not their Purse, yet it ought in Charity, if not also in Equity, to be the Endevour of the Physician, especially when he dealeth with patients that are not rich. For not to say any thing of the Fees of Physicians, which in some places are not very moderate, it is certain that the Bills of Apothecaries, especially in Chronical Diseases, do often prove so chargeable, that even when the Remedies succed, by that time a poor patient is recovered, he is undone; and payes, for the prolongation of his Life, that which should have been his Livelihood. Whence it comes to passe, that the more necessitous sort of people are either faine to languish unrelieved, for want of being able to purchase

purchase health at the Apothecaries rate; or are deterred from applying themselves to the Physician, till their Diseases have taken too deep root to be easily, if at all, eradicated: And this oftentimes, not more through the fault of the Apothecary, than of the Doctor, who in his Prescriptions might, for the most part, easily direct things that would be much more cheap, without being much lesse efficacious.

Now there are several particulars, wherein it may be hop'd that the Naturalist may assist the Charitable Physician to lessen the Charge of his Patients.

And first, He may persuade the Physician to decline that more frequent than commendable Custom, of stuffing each *Recipe* with a multitude of Ingredients.

Tis not that I approve the practice of some Chymists, who too freely censure the compounding of Simples; for I know, at some times, a complicated Distemper requires in its Remedy more Qualities, than are, perhaps, to be met with in any of the known Simples that the Physician hath at command (though one and the same Simple may sometimes answer divers Indications; as a Plant that is hot and dry, may serve for a Distemper that is cold and moist.) And I know too, that in some cases to that Ingredient, that is as it were the Basis of the Medicine, other things must be added either to correct its noxious Qualities, or to allay its violence, or to serve for a Vehicle to convey it to the part affected, or to make it easier to be taken by the Patient, or to preserve it from corruption, or for some such like reason. But yet I think Physicians may well be more sparing, as to the number of the things prescribed, than most of them use to be, both to save charges to their Patients (upon which account it is that I here mention it) and for other Considerations. For the addition of needlesse Ingredients adding to the bulk of the Medicine, makes it but the

Inconveniences of stuffing Receipts with a multitude of Ingredients.

more

more troublesome to be taken, and the more apt to clog the Stomach. And oftentimes the Efficacy of the more useful ingredients, as well as their Quantity in each Dose, is much abated, by their being Yoked with those that are less appropriated, or lesse operative. Besides, it seems a great impediment to the further discovery of the Virtues of Simples, to confound so many of them in Compositions: For, in a mixture of a great number of Ingredients, tis so hard to know what is the operation of each, or any of them, that I fear there will scarce in a long time be any great progresse made in the discovery of the virtue of simple Drugs, till they either be oftener imploied singly, or be but few of them employed in one Remedy. And besides all this, whereas when one of these Mixtures is administred, the Physician expects but such Operations as are suitable to the Qualitie which he conceives will be predominant in the whole Compound, several of the Ingredients may have particular Qualities that he dreams not of, which working upon a Body, that the Physician considers as subject onely to the Sicknesse he endeavours to cure, may therein excite divers latent Seeds of other Distempers, and make new and unexpected commotions in the Body. On which occasion I remember, that whereas Parsley is a very usual Ingredient of aperitive and diuretick Decoctions and Apözems, a famous and learned Oculist tels me, he hath very often observed, That when he hath unawares, or for tryalls sake employed Parsley, either inwardly, or even outwardly, to those that were troubled with great Distempers in their Eyes, he found the Medicines, wherein that Herb was but one Ingredient among many, to cause either great pain or inflammation in the Eyes. In confirmation of which, I shall adde, that a while after having a slight Distemper in my Eyes, I one day found it upon a sudden strangely increased, without be-

ing able to imagine whence these new Symptoms proceeded; till at length, recalling to mind all I had done that day, I remembred, that at Dinner I had eaten Sawce, wherein there was a pretty deal of Parsley mixt with other things. And whereas in divers of these Compositions some noxious Ingredients are allowed, upon a supposition that their ill Qualities will be lost, by their being, as it were, tempered with the rest; though this may sometime happen, yet it would be considered, that in Treacle (especially at one age of it) the *Opium* doth not, considering the small proportion of it to the rest of the Ingredients, loose much, if any of its power, by being mingled with sixty odde other Drugs, which Composition possibly owes much of its virtue to that little *Opium*. And perhaps one reason why those that accustom themselves to be ever and anon taking Physick, though they often escape dangerous Diseases (by preventing the accumulation of humors, and taking their Sickneses at the beginning) are yet almost ever troubled with one Distemper or other, may be, That by the multiplicity of Medicines they take into their Bodies, divers things are excited to disorder them, which otherwise would have lain quiet. I am not ignorant that it may be alledged, That in compounded Medicines, as *Treacle* and *Methridate*, how many soever the Ingredients be, they do so clog and temper one anothers activity in the composition, that there results from them all, one or more Qualities fit for the Physician's turn, and which is the thing he considers and makes use of. And I confesse, that in some cases this Allegation doth not want its weight: For I consider, that a decoction of Galls, and a solution of *Copperas*, though neither of them apart be blackish, will, upon their mixture, turn to Ink; and that when Brimstone, Salt-petre, and Coals, are well mingled together in a due proportion, they make Gun powder, a

mixture that hath Qualities much more active than any of the severed Ingredients. But I fear, that when a multitude of Simples are heaped together into one Compound Medicine, though there may result a new *Crafsis*, yet tis very hard for the Physicians to know before-hand what that will be; and it may sometimes prove rather hurtful than good, or at least by the Coalition, the virtues or the chief Ingredients may be rather impaired than improved. As we see that crude *Mercury*, crude *Nitre*, and crude *Salt*, may be either of them safely enough taken into the Body in a good quantity; whereas of Sublimate, consisting of those three Ingredients, a few Grains may be rank Poison. As for those fam'd Compositions of *Mithridate*, *Treacle*, and the like, though I cannot well, for the mention'd Reasons, commend the skill of those that first devised them, and though I think that when one or two Simples may answer the same Indications, they may for the same Reasons be more safely employ'd; Yet I would by no means discommend the use of those Mixtures, because long Experience hath manifested them to be good Medicines in several Cases. But tis one thing to employ one of these Compositions, when trial hath evinced it to be lucky one, and another thing to think it fit to rely on a huddle of Ingredients, before any Trial hath manifested what kind of Compound they will constitute^d. And, in a word, though I had not the respect I have for *Matthiolus*, and other famous Doctors that devised the Compositions, whereinto Ingredients are thrown by scores, if not by hundreds, yet however I should not reject an effectual Remedy, because I thought that it proved so rather by Chance, than any skill in the Contriver: and I think a Wise man may use a Remedy, that scarce any but a Fool would have devised.

Another

Another thing, upon whose account the Naturalist (whom we here suppose an expert Chymist) may assist a Physician to lessen the expensiveness of his prescriptions, is by shewing That in very many Compositions, several of the Ingredients, and oftentimes the most chargeable, whether they be proper or no for the Disease, are unfit for the way of management prescribed, and consequently ought to be left out. I need not tell You, that since Chymistry began to flourish amongst us, very many of the Medicines prepared in Apothecaries Shops, and commonly the most chargeable, are distilled Waters, Spirits, and other Liquors: and he that shall survey the Books and Bills of Physicians, shall find that (very few perhaps excepted) the most usual Prescription is to take such and such Ingredients (for the most part numerous enough) and pouring on them either Water or Wine, if any Liquor at all, to distill them in *Balneo*, rarely in Ashes or Sand. But I confesse I have not without wonder, and something of indignation, seen in the prescriptions of Physicians, otherwise eminently Learned men, and even in the publick Dispensatories, I know not how many things ordered to be distilled with others in *Balneo*, which in that degree of heat will yeild either nothing at all, as the fragments of precious Stones, Leaves of Gold, prepared Pearl, &c. Or if they do yeild any thing, (for that hath not been yet, that I know of, evinced) do probably yeild but a little nauseous Phlegm, or at least some few loose parts, far lesse efficacious than those that require a stronger heat to drive them up; such as Sugar, Raisins, and other sweet Fruit, Bread, Harts-horn, Flesh prepared by Cossion, &c. which though wont to be thrown away with the *Caput Mortuum*, oftentimes there retain their pristine Texture and Nature, or at least are almost as much more considerable, than that which they yeilded in Distillation, as a
boiled

boiled Capon is, than the Liquor that sticks to the Cover of the Pot. And though as to some of these Ingredients it may be thought that they may yeild even in *Balneo* some of their useful parts, yet this can, with any probability, be supposed but of some such Ingredients: And even as to them it is but suppos'd that they may yeild something in so mild a heat, and how that something will be qualified, is but presumed: at least, by the Analogy of the Experiments vulgarly made, there seems so small cause to expect, that these more fixed Ingredients will adde half so much to the virtue of the Medicines, as they will to the Cost; especially since though it could be proved, or were probable, that fixed Substances may communicate their virtues to Wine or Water, yet it would not follow that those impregnated liquors, distilled in *Balneo*, will carry those virtues with them over the Helm. All which I have more largely proved in another Discourse, where I shew both that the nobler parts of many Ingredients, wont to be distilled in *Balneo*, do commonly remain in the *Caput Mortuum*; and that tis very unsafe to conclude alwaies the Virtues of distilled Liquors from those of the Concretes that afforded them.

But there is another way of putting unfit Ingredients into Medicines, by confounding those in one Composition, which, though perhaps they might apart be properly enough employed, do, when mixed, destroy or lock up the Virtues of one another; and of this fault, even famous Chymists themselves are but too often guilty. I know not how many Processes I have met with, wherein Saline substances, of contrary natures, are prescribed to be mingled, as if because they were all of them Saline, they must be fit to be associated; whereas tis evident to any man, that considers as well as employs the Operations of Chymistry, that there

there are scarce any Bodies in the world, betwixt which there is a greater contrariety, than betwixt acid Salts; and as well those that the Chymists call Volatile, as the Spirits and Salts of Harts-horn, Blood, Flesh, and the like, as those others which are made of Incineration, as Salt of Tartar, and of all burnt Vegetables. So that oftentimes it happens, that by an unskillful mixture, two good Ingredients are spoiled; as when Vinegar, Juice of Lemmons, Juice of Barberries, and the like, are prescribed to be distilled with other Ingredients, whereof the Salt of Wormwood or some othe Plant makes one; for then the *acid* and *alcalizate* Salts working upon one another, grow more fixed, and yeild in *Balneo* but a Flegm: and so Spirit of Urine, which is highly volatile, and Spirit of Salt, which is also a distilled Liquor, being mingled together, will, by their mutual Operation, constitute a new thing, which in such a heat as that of a Bath, will yeild a Flegm, leaving behind the nobler and active parts concoagulated into a far more fixed Substance, much of the nature of *Sal Armoniack*. And indeed where Salts, especially active ones, are made Ingredients of Mixtures, unless they be skilfully and judiciously compounded, it often happens that they spoil one another, and degenerate into a new thing, if they do not also spoil the whole Composition, and of divers useful Ingredients compose one bad Medicine.

That *acid* and *alcalizate* Salts being mixed, grow thereby more fixed, and yeild in *Balneo* but a phlegm.

The same is observed of the mixture of the Spirit of Urine (by it self highly volatile) and Spirit of Salt.

CHAP. V.

ANother way by which the Naturalist (skilled in Chymistry) may help to lessen the Chargeableness of Cures, is by shewing, that as to divers costly Ingredients, wont to be employed in Physick, there hath not yet been sufficient proof given of their having any Medical Virtues at all, or that at least

That the naturalist discovers the mis-application and use of Gems and divers other costly Ingredients.

least as they are wont to be exhibited, either crude, or but slightly prepared in *Fuleps*, *Electuaries*, &c. there is not any sufficient evidence to perswade us, that their efficacy is as much greater than that of many cheap Ingredients, as their price is. I am not altogether of their mind, that absolutely reject the internal use of Leaf-Gold, Rubies, Saphyrs, Emeralds, and other Gems, as things that are unconquerable by the heat of the Stomach: For as there are rich Patients that may, without much inconvenience, goe to the price of the dearest Medicines; so I think the Stomach acts not on Medicines barely upon the account of its heat, but is endowed with a subtle dissolvent (whence soever it hath it) by which it may perform divers things not to be done by so languid a heat. And I have, with Liquors of differing sorts, easily drawn from Vegetable Substances, and perhaps unrectified, sometimes dissolved, and sometimes drawn Tinctures from Gems, and that in the cold. But though for these and other Considerations, I do not yet acquiesce in their Reasons, that laugh at the administration of crude Gems, &c. as ridiculous; yet neither am I altogether of their Adversaries mind. For though I deny not the Glasse of *Antimony*, which looketh like a kind of Gem or Ruby, will easily enough impart to Liquors an Emetick Quality; yet I know too, there is great odds betwixt Rubies and other Gems (which will endure violent Fires, and remain undissolved in divers strongly corrosive Liquors) and the Glasse of *Antimony*, which is a Body so far lesse compact and fixed, that Spirit of Vinegar it self will work upon it, and a strong Fire will, in no long time, dissipate it into Smoak. But that which I chiefly consider on this occasion, is, That tis one thing to make it *probable*, that tis *possible*, Gold, Rubies, Saphyrs, &c. may be wrought upon by a humane Stomach; and another thing to shew both that they

A difference betwixt the fixedness of a Gem, and of Glasse of *Antimony*.

they *are wont* to be so, and that they *are* actually endowed with those particular and specifick Virtues that are ascribed to them: nay, and (over and above) that these Virtues are such and so eminent, that they considerably surpasse those of cheaper Simples. And I think, that in Prescriptions made for the poorer sort of Patients, a Physician may well substitute cheaper Ingredients in the place of these precious ones, whose Virtues are not half so unquestionable as their Dearness.

What strange Excellency there may be in the *Aurum Potabile*, made by a true *Adeptus*, or by a Possessor of the *Liquor Alchabest*, I shall not now dispute, not knowing what powerful and radical Dissolvents the profound skill of such Men (if any such there be) may furnish them with, to open the Body of Gold. But as for the attempts and practices of the generality of Chymical Physicians to make Gold potable, besides that, their attempts to make their Solutions volatile, succeed so seldom, that even Learned Physicians, and Chymists have pronounced the thing it self unfeasible; I confesse, I should much doubt whether such a potable Gold would have the prodigious Virtues its Encomiasts ascribe to it, and expect from it. For I find not that those I have yet met with, deliver these strange things upon particular Experiments duely made, but partly upon the Authority of Chymical Books, many of which were never written by those whose Names they bear. And others, I fear, commend *Aurum potabile*, prepared after another guesse manner than that we are now speaking of, partly upon a presumption that if it be made volatile, it must be strangely unlocked, and exalted to a meer Spiritual Nature; and partly upon rational Conjectures (as they think them) drawn from the nobleness and preciousness of Gold. But for my part, though I have

Concerning
Aurum potabile.

long since bethought my self of a way, whereby I can, in a short time, and a moderate Fire, make my *Menstruum* bring over crude Gold, in quantity sufficient to make the Liquor look, at the first or second Distillation, of a high golden colour; yet finding that I could, by an easie art, quickly recover out of this volatile Liquor, a corporal and malleable Gold, I dare not brag that my Tincture (as an Alchymist would call it) must needs do strange feats, because there is so noble a Metal brought over in it. And if this or other preparations of *Aurum potabile* prove good Medicines, it would be further enquired, Whether the Virtues may not in great part be rather attributed to the *Menstruum*, than the Gold (that requiring a very subtle Liquor to volatilize it) or to the association of the Corpuscles of the Gold, with the saline particles of the *Menstruum*, into a new Concrete, differing enough from Gold, though never so well opened. And as for the noblenesse and preciousnesse of this Metal, That depends upon the Estimation of Men; whence in *America* the *Indians*, that abound with it, had not such a great value for it. And in divers Countries, at this day, it is postponed to Iron, or to Copper, and hath rather a Political (if I may so speak) than a Natural Virtue. Nor will it follow, that because it is the fixedst and pretiouslest of Metals, that therefore it must be an admirable Medicine: For we see that Diamonds, though they be the hardest of Bodies, and very fixed ones, and in much greater esteem, *ceteris paribus*, than Gold; are yet so far from being accounted highly Medicinal, that they are commonly (though perhaps not so deservedly) reckoned among Poysons. But I see I have digressed. That which I chiefly aimed at, being to inculcate, that whether Gold and Gems, and the like precious ingredients, may be good Medicines or no, it were a good work to substitute cheap ones for the poorer

sort of Patients; and that Physicians are much too blame who prize Simples, as Drugsters do, according as they are brought from remote Countries, and are hard to come by, and cannot imagine that what doth not cost much Money in the Shops, can do much good in the Body; as if God had made Provision onely for the Rich, or those People that have Commerce with *China* or the *Indias*: whereas indeed it may oftentimes happen, that what the Chymists call their *Caput Mortuum*, and perhaps throw away as an uselesse *Terra Damna*, may have as great Virtues as those nobler Parts, as they call them, which they have extracted from it; and a despised simple, nay even an Excrement or an Insect, may in some cases prove nobler Remedies, than those that men call and think very noble Bodies, not to say, than I know not how many Extracts and Quintessences.

I shall nor trouble You with many Instances to prove this Doctrine, having more fully discoursed of it, in one part of another Treatise. But yet some Instances I suppose You will here expect, and therefore I shall present you with a few of those that at present come into my mind.

When the Distillation of *Aqua fortis* is finished, the *Caput Mortuum*, as deserving that name, is wont, by common Distillers, to be thrown away; and I have seen whole heaps of it thrown by, as uselesse, by those that make *Aqua fortis* in quantity to sell it. And yet this despised Substance doth, in common Water it self, yeild a Salt, which being onely depurated by frequent Solutions and Filtrations, is that famous *Panacea duplicata*, or *Arcanum Duplicatum*, which that great *Virtuoso* and knowing Chymist, the Duke of *Holstein*, whose name it also beareth, thought worth purchasing at the rate of Five hundred Dollars, and of which the Prince's experienced Physician thus writes to the

Examples of great medicines drawn from unpromising Bodies.

Of the efficacy of unpromising Medicines.

The Duke of *Holsteins Panacea duplicata* is made of the vulgarly despised *Caput mortuum* of *Aqua fortis*.

Schroder phar-
macop. l. 3. 6. 23.

Schroder, *Mille Experimentis Salis huius Efficaciam An-
nostra comprobavit in melancholicis affectibus, febribus quibus-
cunq; continuis & intermittibus, calculo, scorbuto, &c. Quin
& somnum conciliasse praesertim in Melancholicis non semel no-
tavimus. Dosis à scrup. 1. ad scrup. 2. Libras aliquot quotannis
absumimus.* And another very skilful Physician, that frequent-
ed that Excellent Princes Court, confirmed to me the same
Medicines diuretick and deoppilative Virtue. (But upon my
own Experience I can say little of it; having casually lost a
great quantity I caused to be prepared to make tryal with, be-
fore I had opportunity to imploy it.

Flores Colcotha-
rini are made of
the Caput mor-
tuum of Vitriol.

But whereas in the *Caput Mortuum* of *Aqua fortis* there
remains pretty store of easily-soluble Salt; in the *Caput mor-
tuum* of *Vitriol*, when not onely all the Oyl is forced away
by the Fire, but all the fixed Salt is exactly separated by
Water, there seems to remain nothing but a worthless *Terra
Damnata*. And yet it is of this that, as I shall teach you ere
long, I make those *Colcotharine* Flowers, which are possibly a
nobler Medicine than either the Oyl, the Spirit, or the Salt of
Vitriol.

Boatius in c. 45.
Garcia ab Orta.
A Comparison
between the Be-
zoar-stone, and
the Stone cut
out of man's
bladder.

As for the *Bezoar-stone*, which is so often prescribed by
Physicians, and so deerly paid for by Patients, the Experi-
enced *Boatius*, a very competent Witnesse in this case (and
whose account of the manner of its Generation, agrees the
best of any I have seen with that I received from an Intelli-
gent Person that was imployed into *Persia* by the late King)
hath in one place a passage concerning it; and elsewhere writes
such things of the Stone cut out of a Man's Bladder (though
that, whilst crude, be despised as a thing vile and uselesse in
Physick) as may be justly applicable to our present purpose:
Ceterum (saith he, speaking of the *Bezoar-stone*) *quantum
ad hyperbolicas huius lapidis virtutes & facultates portento-*

non tantas in comille Experimentis edoctus inveni. And elsewhere speaking of those contemptible and excrementitious Stones that are found in humane Bladders, Nil porro (saith he) de his lapibus addo, ne videar eos elevare, & lithotomos monere ut vel cum periculo plures mortales fecent. Hoc certe comperam habeo, lapidem in vesica hominis repertum, urinam & sudores probè ciere quod tempore ingentis illius pestis qua Anno 1624, & 1625, Leydam patriam meam, & reliquas Hollandiae civitates miserandum in modum vastabat, in penuria lapidis Bezoartici nos exhibuisse memini, & sudorificum (ausim dicere) melius & excellentius invenisse, &c.

Idem c. 46.
Gartiaab Orta.

Soot is generally looked upon as so vile a thing, that we are fain to hire men to carry it away; and yet, as I elsewhere shew that it is a Body of no ignoble nature, so I must here tell you, that it is no unuseful one in Physick. And not to mention that *Riverius* commends it crude, to the quantity of a Drachme, in Plurisies; I have tried, with the Spirit of it well drawn, some things, that make me look upon it as a considerable Liquor. And I know by their own confessions, that some Medicines, even of eminent Physicians, that passe under other Names, have the Spirit of Soot for their principal Ingredient. I knew a not unlearned Emperick, who was exceedingly cried up for the Cures he did, especially in difficult distempers of the Brain, by a certain Remedy, which he called sometimes his *Aurum potabile*, and sometimes his *Panacea*; and having obtained from this Man, in exchange of a Chymical Secret of mine he was greedy of, the way of making this so celebrated Medicine, I found that the main thing in it was the Spirit of Soot, drawn after a somewhat unusual, but not excellent manner; in which Spirit, Flowers of Sulphur were, by a certain way, brought to be dissolved, and swim in little drops that looked of a golden colour.

Medicines out
of Soot.

You

You will easily grant, *Pyrophilus*, that there are not any Medicines to be taken into the Body more cheap and contemptible than the Excrements of Men and Horses, and than Insects: and yet that even these want not considerable Medical Virtues, we elsewhere shew. And (not to meddle with such nasty things as the grosser sort of Humane Excrements, though they, outwardly applied, either in Powder or otherwise, doe sometimes perform strange things,) the juice of Horse-dung, especially of Stone-horses, being strongly expressed (after the Dung hath been a while steeped in Ale, or some other convenient Liquor, to facilitate the obtaining the Juice, and to afford it a *Vehicle*) doth oftentimes so powerfully relieve those that are troubled with the stoppage of Urine, with Wind, Stiches, and even with Obstructions of the Spleen and Liver, that You, *Pyrophilus*, and I, know a great Lady, who though very neat, and very curious of her Health, and wont to have the attendance of the skilfullest Physicians, scruples not, upon occasion, to use, as I have known her do, in Silver vessels, this homely Remedy, and prefer it to divers rich Cordials, and even to what some Chymists are pleased to call *Essences* or *Elixirs*. And with the same Remedy very many poor people were cured of the Plague it self; when it lately swept away so many thousands in *Ireland* (and the Doctors with the Patients, as I was assured by a person who cured so many) as to invite men to secure themselves that assistance, by refusing the Party the liberty to leave the Town. But (to adde that upon the By) this person, in exchange of a Secret of mine, confessed to me, That the *Arcanum*, which had cured such numbers, and to which the Juice of Horse-dung was a *Succedaneum*, was onely a good Dole of the Powder of fully ripe Ivy-berries, which did usually, as also the Horse-dung, work plentifully

The use of horse
dung.

An *Arcanum*
of Ivy-berries.

by

by Sweat, and which I presently remembred to be one of those few things that *Helmont* commends against the Plague.

The Medical Virtues of Man's Urine, both inwardly given, and outwardly applied, would require rather a whole Book, than a part of an Essay to enumerate and insist on: But referring you to what an industrious Chymist hath already collected touching that Subject, I shall now onely adde, That I knew an ancient Gentlewoman, who being almost hopelesse to recover of divers Chronical Distempers (and some too of these abstruse enough) was at length advised, instead of more costly Physick, to make her Morning-draughts of her own Water, by the use of which she strangely recovered; and is, for ought I know, still well. And the same Remedy is not disdained by a person of great Quality and Beauty, that You know, and that too after she had travelled as far as the *Spaw* for her healths sake. And I remember on this occasion, that passing once through one of the remoter parts of *England*, I was visited by an Emperick, a well-wisher to Chymistry, but a Novice in it, who pressing me to communicate to him some easie and cheap Preparation, that he might make use of among the Countrey-people, I directed him to Distill with a gentle heat, a Spirit out of Urine, purified for six or seaven Weeks on a Dung-hill, or some analogous heat, but in well clos'd Glasses, or other glazed Vessels, and having rectified this Spirit once or twice, that it might be rich in volatile Salt, to give ten, twenty, or thirty drops of it in a convenient Liquor for the Plurisie, for most kind of Coughs, and divers other Distempers, as a *Succedaneum* to the Essence of Harts horn. And a while after, this Emperick returned me great thanks for what I had taught him: and I found by him and others, that he had cured

Medicines out
of man's body.

cured so many with it, especially of Pleurifies (a Disease frequent and dangerous enough in that Country) that this slight and seemingly despicable Remedy had already made him be cryed up for a Doctor, and was like to help him to a comfortable Subsistence.

Great store of healthy mens Blood is wont to be thrown away, as altogether uselesse, by Chirurgions and Barbers, that let Men blood (as is usual in the Spring and Fall) for prevention of Diseases; and yet from a Man's blood skilfully prepared, though without addition of any thing, save Spirit of Wine to keep it at first from putrifying, may be easily obtained a Spirit and volatile Salt, that have much the same Virtues, with those of the newly mentioned Spirit of Urine, but more Noble (as far as I can gueffe) than either that, or even Spirit of Harts-horn, as having performed in Consumptions, Asthma's, and other obstinate Cases, such things as I, as well as others, could not but admire. But in this place, mentioning Humane Blood onely *intransitu*, I shall pretermitt what I have observed about the preparation of it; yet leaving You a liberty to call for my Observations upon a Medicine, which perhaps is Nobler, than the most costly and elaborate Chymical Remedies that are wont to be sold in Shops, and which hath been almost alone excepted out of the Censure made by a Learned Modern Writer, of the Medicines found out by Chymistry.

Medicines out
of Blood.

The greatest effects
of Millepedes in
the Stone.

I shall adde but one instance more, of the Efficacy that may be found in the most obvious and abject Creatures; and this instance is afforded me, by those vile Insects commonly called in English, Wood-lice, or Sows, and in Latine *Millepedes*, which I have often both recommended to others, and taken my self. What their Virtue is against the Stone, the World hath been informed by *Laurembergius*,
who

who hath published a narative, how by the use of them he was cured, even of the Stone in the Bladder; and he was invited to use them by credible information, that others had been cured of that Disease, by the same Remedy. And of late Years in *England*, an Emperick being much resorted to, for the relief he gave in that tormenting Sickness, a Physician, famous for his Learned Writings, wondring at what was done, was very curious (as himself afterwards told me) to find out the Emperick's Secret, and at length was so industrious as to discover, That 'twas a slight preparation of *Millepedes*. But my having found them in my self very diuretical and aperitive, is not that which chiefly recommends them to me; For I knew, and lived in the same House with a pious Gentlewoman, much better skill'd in Physick, than her Sex promised, who having lost the use of one Eye by a Cataract, and being threatened by the Oculists with the speedy loss of the other, especially in regard of her being very aged and corpulent, she neverthelesse did, for some Years, to my wonder, employ her Eye to read and work with, without finding, as she told me, any decay in it, or any encreasing danger of a Suffusion: And she assured me, that her Medicine was to bruise first five *Millepedes*, then ten, then fifteen, then twenty, &c. (daily encreasing the number by five, till it had reach'd, if I mistake not fifty or sixty) in White-Wine (or Small-Ale) and to drink upon an empty Stomach, the strongly express'd Liquor; and when I desired to know how she came by this Specifick, she answered me, That having made enquiries among all those, both Oculists and others, that she thought might assist her against so sad a Distemper, she was advised to the use of *Millepedes*, by a Woman, that not only much magnified their virtue in such cases as hers, but assured her (if I much mis-remember not) that she her self had

In Suffusions of
the Eyes.

had been cured by them, of no lesse than an incipient suffusion in one or both of her Eyes,

And reall Ca-
taracts.

[Since the writing of the former part of this Page, relating what I newly told you to a very Ingenious Physician, he assures mee, That being some Years since in *Holland*, he there met with a woman who was cured, as her selfe confessed to him, of a reall Cataract, by the Juice of *Millepedes*, beginning with that of three at a time, and so increasing to nine at once; and then gradually lessening the Dose by one Insect each day, till she were come back to three at a time; after which, she gradually increased the Dose as before: And he addes, That this Woman was adviled to this Medicine by an Emperick, that was said to have performed divers Cures with the same Medicine.]

In sore Breasts
and Fistula's-

[What strange things these same *Millepedes* have done in the sore, and even exulcerated, Breasts of Women (provided they be not cancerous) though they be given without preparation onely to the number of three at first, and so on to nine at once (which number may perhaps by usefully increased) stamp'd with a little White-wine or Beer, that the Liquor strain'd out may be drunk in a draught of Beer, Morning and Evening; during with time, Linnen cloathes dipped in White-Wine, and applyed warme, are to be kept upon the Breast, I may elsewhere have a fitter opportunity to relate. I shall now onely subjoyne, as a further prooffe of the great Virtue that may be even in vile and costlesse Insects, and that without any elaborate or Chymical preparation, this memorable Story, That after all the tryals I had made about these *Millepides*, I met with a young Lady, who by divers strangely winding and obstinate *Fistula's* that had made themselves Orifices in many places of her Body, was not onely lam'd, but so consum'd and weakned, that she was scarce able to turne

her

herself in her bed; and this, notwithstanding the utmost endeavours of the eminentest Chirurgions, both English and Foreigners, that could be procured: But when both the hopes of her Friends, and those that endeavour'd to cure her, were lost, she was in a short time not onely freed from her *Fistula's* but recovered to a thriving condition of Body, by the frequent use of an internal Medicine, which as both her Parents and the Person that taught it them informed me, was onely a Drink (to be taken twice or thrice a day) made of a small proportion of a couple of Herbs (very common, and not much more likely to do Wonders in this case, than Wormwood and Mint) and of Three hundred of these *Millepedes* well beaten (when their Heads are pull'd off) in a Morter, and runn'd up with the Herbs, and suspended in four Gallons of Small-Ale, during its fermentation. The wonderful efficacy of this Medicine in this and many other cases, which by occasion of this Cure were related to me, being almost wholly ascrib'd to the *Millepedes*, by the Illustrious Imparter of it, whose leave I have not yet, by naming him, to disclose, that this is the Secret He makes use of,

CHAP. VI.

ANother way there is, whereby the Naturalist may assist the Physician to make the *Therapeutical* part of Physick less chargeable, and that is by shewing those that are wont to employ most Chymical Remedies, that much of the cost and labour in many cases might be spared. I am not altogether of their mind, that indiscriminately cry down Chymical Preparations as excessively dear: For of many of those that seem very dear, when bought by the Pound or the Ounce, a Dose may be cheap enough; as if for instance, an Ounce of precipitate

That the Naturalist discovers how much of the cost and labour in making many Chymical Remedies may be spared.

A comparison
of Chymical
Remedies with
Galenical ones
in point of
cheapness.

pirate of Gold, and *Mercury*, cost ten times its weight of Silver, under which rate I have bought it of honest Men, that make it themselves, yet that Ounce containing 480 Grains, (of which three or four may be a Dose) a taking of this dear Powder, may cost far less than a Dose of many *Galenical* Medicines, where the quantity that is taken at once, makes up what is wanting in the costliness of the Ingredients. But though this be the case of *some* Chymical Remedies, yet we must not deny, that *many* others are chargeable, and though perhaps not more so than many *Galenical* ones employ'd for the same purposes : Yet if those be dearer than they need be, that grievance ought to be redressed in Chymical Medicines, how justly soever the same thing may be imputed to *Galenical* ones.

Now there are two particulars, wherein the Chymists, and those Physicians that intimate them, are wont to be blameable in reference to this matter; The one, their employing Chymical Preparations on all occasions, even where Simples or slight Compositions might serve the turn: and the other is, Their making many of their Preparations more laborious, and consequently more chargeable than needs.

Of the use and
commendation
of simples, even
by the most a-
ble Chymists.

As for the first of these: 'Tis known there are divers Chymists, and others that practice Physick, who so dote upon the Productions of their Furnaces, that they will scarce go about to cure a cut Finger, with lesse than some *Spagyricall* Oyl of Balsam: And in slight Distempers have recourse to Chymical, and perhaps to Mineral Remedies, which being; for the most part, such as vehemently alter the Body, especially by heating and drying it, they do often more harm than good, when employed in cases that need not such active Medicines. And methinks those that practise, as if Nature presented us nothing worth the accepting, unless it be cook'd
and

and perfected by *Vulcan*, might consider, That *Paracelsus* himself oftentimes employeth Simples for the cure even of formidable Diseases. And though for particular Reasons I be inclinable enough to think, that such searching and commanding Remedies, as may be so much of kin to the Universal Medicine, as to cure great numbers of differing Diseases, will be hardly obtained without the help of Chymical Preparations, and those perhaps of Minerals: Yet as to most particular Diseases, especially when not yet arriv'd to a deplorable height, I am apt to think, that either Simples, or cheap or unelaborate *Galenical* Mixtures, may furnish us with Specificks, that may perform much more than Chymists are wont to think, and possibly be preferable to many of their costly *Magisteries*, *Quint essences*, and *Elixirs*. *Helmont* himself, a Person more knowing and experienced in his Art, than almost any of the Chymists, scruples not to make this ingenious Confession: *Credo (saith he) simplicia in sua simplicitate esse sufficientia pro sanatione omnium morborum*: And elsewhere he truly affirms, That there may be sometimes greater Virtue in a Simple, such as Nature affords it us, than in any thing that the Fire can separate from it. And certainly the Specifick Properties of divers, if not most Simples, are confounded and lost by those Preparations, wherein that Texture, which is the Foundation of those Properties, is either destroyed by the Fire, or changed by the taking away of some of the Parts; or the adding of some other Substance to it, with which compounded, it may constitute a new thing. The more Judicious of the Chymists themselves do severally of them now acknowledge, that the bare reducing of Pearls to fine Powder, affords a Medicine much richer in the Virtues of the Pearles, than the *Magistery*, prepared by dissolving them in acid Spirits, and precipitating them with Oyle of

Helmont. Pharmac. & D. specul. Nat. p. 453.

Powder of Pearl more operative than *Magistery*.

So crude Harts-
horn, then
Magistery.

An excellent
simple medicine
to stanch blood.

Another like
Medicine for
spitting and vo-
miting of blood

of *Tartar*, and afterwards scrupulously edulcorating them. And one may easily observe, that by making the *Magistery* of Harts-horn the same way, the Virtues seem to be more locked up than they were in the crude Horn, which may easily enough impart its Virtue in the Body, since fair Water will reduce a good part of it into a Jelly; whereas the *Magistery* remains a fixed Powder not easily dissoluble, even in acid *Menstruums*; and, which thrown upon hot Iron, will scarce send forth that stinking Smoak, which argues the avolation of the saline and sulphureous Parts. I never knew any of the vulgar Chymists *Essences* or *Elixirs* half so powerful a Remedy to stanch Blood, as a slight Mixture of two drachms of *Hysciamum*, or Henbane-seed, and the like weight of white Poppey-seeds, beaten up with an Ounce of Conserve of Red-Roses, into a stiffe Electuary; with which, given, in the quantity of a Nutmeg, or Wall-nut, I have snatched some, as it were, out of the Jaws of Death; and with which an eminent Physician, now dead, affirm'd, That he, and the Inventor of the Remedy, had very frequently cured profuse bleedings at the Nose; and in Women, at other Parts besides. Nor did I ever see, to give an instance in a resembling Disease, such wonderful Effects against spitting and vomiting of Blood, of the most elaborate Chymical Preparations, as I have of a slight Syrrup, made onely of a convenient quantity of fine Sugar, and the strongly expressed Juice of twelve handfuls of Plantine leaves, and six Ounces of fresh Cumfrey-roots, well beaten together; with which Syrrup, besides what I have tryed my self, two eminent Physicians performed in that Disease unusual Cures, though (for reasons elsewhere mentioned) I forbear to name them, otherwise than by telling you, That one of them is that ingenious & Friendly Dr. T. C. to whose skill both you and I owe so much.

But

But I consider further, that as oftentimes those I am reasoning with, make use of Chymical Remedies, when much more easily parable ones may suffice; so in divers cases, where Spagyricall Medicines are proper enough, their Preparations of them are more tedious and expensive than is necessary. There are more than a few who seldome prescribe, and seldomer esteem a Chymical Process, that is to be perfected in less than many Weeks, as if a Chymical Medicine like an *Embryo*, must needs be an Abortive, if it be produc'd in less than so many Moneths. And, as if in preparations, the Virtue depended less on the skilfulness, than the elaborateness, they seem to estimate the efficacy of Remedies by the time and pains requisite to prepare them, and dare not think, that a Medicine can quickly cure, that was not long a making; as indeed theirs (especially those where Cohobations and Digestions, till they have such and such effects upon the Matter to be wrought on by them, are prescrib'd) are many of them far more toilsome and tedious, than those that have but read such Processes, without working them, are apt to suspect. And this is the humour of divers, not only as to those stable Medicines, that ought alwayes to be found ready in Apothecaries Shops, but even as to those that are design'd for particular cases, and perhaps acute Diseases; in which Emergencies, if a Physician had no other Remedies than those he must make according to such Processes, it would, I fear, too often happen, that before the Medicine could be ready, the Patient would either be past the need of it, or past the help of it. And that which oftentimes encreaseth the tediousness of Chymical Processes, is the unskilful Prescriptions of those that devise them. 'Tis not unusual in Chymists Writings to meet with Processes, wherein the Matter to be prepared, is expos'd to I know not how many several

severall successive Operations: But if you should aske, Why such a thing should be, for instance, rather precipitated, than exhald *ad siccitatem*; or why such or such an Operation is to be used after such another, rather than before it; nay, perhaps, if one should demand, why some of those Operations should be used at all, the Devilsers of those unskilfull Processes would possibly assoone be able to finish their operations, as to give a satisfactory answer. Nay, sometimes they lengthen their Processes by Operations, so injudiciously prescrib'd, that they crosse one another; And the Chymist vexeth himselfe, and the matter he workes upon, to leave it at last no better, if not a worse, Medicine than he found it; of this we have already given an instance in the common *Magisteries*.

That many times Chymists by their tedious & injudicious preparations; alter the Medicine and make it worse.

But I lately met with another Example of it, in the Writings of a Famous, Moderne Chymist; where, to purifie the fixed Salt of Vegetables, to the height after I know not how many Solutions, Filtrations and Coagulations (which alone would abundantly serve the turn) he prescribes the dissolving them in *Aqua fortis*, after which, he saith, they will become very pure and chrySTALLINE, and not so easily resolvable in the Aire: Of which I make no doubt, for divers Yeares before I met with his Processe, I have, with the fix'd Salts of more than one kinde of Vegetable, by joyning them with *Aqua fortis*, and after a while exhaling the superfluous moysture, made good inflammable *Salt-Peter*; by which you may easily guesse, how judiciously the solution in *Aqua fortis* is prescrib'd onely as a further depuration, and how fit such Authors are to be credited, when they ascribe to these ChrySTALLINE Salts the severall Virtues (and those improved too) of the respective Vegetables, from which the *Alcalies* were obtained. And indeed, as to those exact Depurations, which some Chymists

So the dissolving the Salts of Vegetables in *Aqua fortis* to make them pure and ChrySTALLINE, alters their Virtues and makes them inflammable as *Salt-Peter*.

so strictly require in all their Preparations, though their Processes be oftentimes hereby made incredibly tedious, I will willingly allow, nay assert, that in some cases, and especially in the making of powerful *Menstruums*, which by their activeness and penetrancy are to unlock other Bodies, Chymists do rather erre in making their Depurations lesse exquisite than they should, than on the other hand. Yet in many other cases, such exact refining and subtiliation of a Remedy is not so necessary as they imagine; and sometimes too may do more harm than good, by sequestering those parts of a Simple, as *faces*, which concurred with the finer parts to that determinate Texture, whereon the Specifick virtues of it did principally depend: but of this more elsewhere. And therefore I shall here present you with two or three Instances, to shew You, That Remedies, at least as noble as such vulgar Chymical ones as are most tedious and costly, may be prepared in a shorter time, and cheap enough to be fit for the use of the poor.

And to comply, *Pyrophilus*, with your curiosity to know the preparations of those Chymical Medicines, that I doe the most familiarly imploy, the three following instances shall be of such, namely, the *Flores Colchotaris*, the *Balsamum Sulphuris crassum*, and the *Essentia cornu Cervini*, that you may see vvhhat slight and easie preparations afford the Remedies, whose Effects you have so often heard of, if not also seen.

The first of these, is the same Powder, which passeth under the name of *Ens Veneris*, which appellation we gave it not out of a belief that it equals the Virtues ascribed by *Helmont*, to what he calls the true *Ignis Veneris*, but partly to disguise it a little, and partly upon the account of the occasion whereon it was first found out, vvhich was, That an

Industrious Chymist (whom You know) and I, chancing to look together upon that Tract of *Helmonts*, which he calls *Butler*, and to compare it somewhat attentively with other passages of the same Author, we both resolved to try, Whether a Medicine, somewhat approaching to that he made in imitation of *Butler's Stone*, might not be easily made out of calcined Vitriol: and though upon Tryals we found this Medicine far short of what *Helmont* ascribes to his, yet finding it no ordinary one, we did, for the Minerals sake it is made of, call it *Ens primum Veneris*.

The preparation
on and virtues
of *Ens Veneris*.

The Preparation, in short, is this: Take good *Dantzick* Vitriol (if you cannot get *Hungarian* or *Goslarian*) and Calcine it till the *Calx* have attained a dark Red, or Purplish colour; then, by the frequent affusion of Boyling, or at least warm Water, dulcifie it exactly: and having freed it as well as You can from the Saline parts, dry it thoroughly, and after mix it exquisitely, by Grinding, or otherwise, with an equal weight of pure *Sal Armoniack*, very finely powdered. Put this Mixture into a Glasse-Retort, that may be but a third part filled with it, and subliming it in a Sand-Furnace, by degrees of Fire, for ten or twelve hours, towards the latter end encreasing the fire, till the bottom of the Retort (if You can) be brought to be red hot. That which is sublim'd must be taken out, and if it be not of a good yellow, but pale, (which usually happens for want of an exact commision of the Ingredients) it may be returned to the Residue, mingled better with it again, and sublimed once more. The yellow or reddish Sublimate may be sublim'd a second time, not from the *Caput mortuum*, but by it self; but if you re-sublime it oftner, You may, though you will think that strange, impair the Colour and the Sublimate, instead of improving them. The Dose is from two or three Grains to ten or twelve (in some Bodies

Bodies it may be increased to twenty or thirty, without danger) in distill'd Water, or small Beer, or other convenient Vehicles: it may be given at any time upon an empty Stomach, but I most commonly give it at Bed-time. It works, when it works sensibly, by Sweat, and somewhat by Urines. That it is a potent Specifick for the Rickets, I think I scarce need tell *Tou*, *Pyroph.* whose excellent Mother and Aunt, together with some Physicians, to whom I also gave it ready prepared, have cured perhaps a hundred, or more, Children, of that disease, divers of whom were looked upon as in a desperate condition. I give it also in Feavers, and other Distempers, to procure sleep, which it usually doth where it is wanting. In the Head-ach likewise, in which, if the Disease be inveterate, the Remedy must be long continued; with the like admonition it hath done Wonders *in suppressione Menstrui obstinata*. In the Wormes it hath sometimes done strange things; and for provoking of Appetite, I remember not that I have either taken or given it without success: And though I seldome take (for I often give more) above two or three Grains of it at a time, yet in that small Dose it usually proves Diaphoretical to me the next Morning.

But the Experiments we have had of the several Virtues and efficacy of this Medicine, would be here too tedious to recite, and therefore I shall now passe them by; though, if you require it, I shall not be backward to set you down, by way of Observations, most of the cases wherein I or my Friends have given it, and of the principal Cures that have been performed by it. In the meantime, because this exalted *Colcothar*, being given in so small a Dose, may prove, if it be rightly and dexterously prepared, what *Helmont* saith of his imitation of *Butler's* Drift, a Medicine for the Poor, and

yet requires more care, not to say skill, to prepare it well than by the bare reading of the Proceſſe you will imagine; I ſhall, to gratifie your Charity, annex to the end of this Eſſay (for to infer them here would make too prolix a Digreſſion) as many of the particulars relating to the preparation of it, as I can readily meet with among my looſe Notes. And leaſt you ſhould think me a Mountebank for want of knowing in what ſenſe it is that I commend this and the other particular Medicines, I ſhall likewiſe to thoſe Obſervations ſubjoyn a Declaration of my meaning in ſuch particulars, and of the ſenſe, wherein I deſire You ſhould underſtand what You meet with in the praiſe of Remedies either in this Eſſay, or any other of my Writings, which I hope it will be ſufficient to give You this Advertiſment of once for all.

The next Medicine I am to mention to you is the *Baſſum Sulphuris*, which being made but with groſs Oyls, drawn by Expreſſion, may be called *Crallum*, to diſtinguiſh it from the common and thinner Baſſom of Sulphur, that is made with the diſtilled Oyl or Spirit of Turpentine.

The Preparation
and Virtues
of the *Baſſum
Sulphuris
Crallum*.

This Baſſom is made in an hour or leſſe, without a Furnace, onely by taking to one part of good Flower of Brimſtone four or five times as much (in weight) of good expreſſed Oyl, either of Olives, or Nuts, or Poppey-ſeeds, and boyling the former in the latter in a Pipkin half filled with both, till it be perfectly diſſolved into a Bloud-red Baſſome. But as eaſie as this Preparation ſeems (and indeed is) to them that have often made it, it will not at firſt be ſo eaſie to make it right. For the Fire, which ought to be of well kindled Coals, muſt be kept pretty quick, and yet not over quick, leſt the Oyl boyl over, or do not well Diſſolve the Flower of *Sulphur*, but turn them with its ſelf into a clotted and almoſt Liver-coloured Maſſe. And to avoid

avoid these inconveniences, and the aduſtion of the Matter, ſpecial care muſt be had to keep it conſtantly ſtirring, not only whiſt the Pot is over the Fire, but after it is taken off, till it be quite Cold. You may, if you think fir, Diſſolve this ſimple Baſom in Chymical Oyl of Anny-ſeeds, or any other Eſſential Oyle, like to advance its Efficacy in this or that particular Diſtemper; but thoſe Oyls being generally very hot, I moſt commonly preſcribe the Baſom without thoſe Additions, eſpecially if long Diſeſtion have ſomewhat leſſened the Offeſſivenesse of the ſmell, which though no peculiar fault of this Preparation, being common to Sulphureous Medicines, is yet the chief inconvenience of it. I will not too reſolutely affirm that this is the very *Baſamum Sulphuris Rulandi*, of which that Author relates ſuch wonderful things in his Centuries; but if it be not the ſame, it is ſo like it, and ſo good, that I doubt not but by peruſing thoſe Centuries, You may find divers uſes of it, that I have not made tryal of. And in Coughs, old Strains, Bruiſes, Aches, (and ſometimes the incipient ſits of the Gout it ſelt) and eſpecially Tumors, ſome of Your friends can inform You, that it doth much greater things than moſt men would expect from ſo ſlight and eaſie a Preparation; and indeed greater than I have ſeen done by very coſtly and commended Baſoms and Oyntments, ſold in Apothecaries Shops. And in thoſe Obſervations, I lately told You, You might command, you will find that this Baſom outwardly applied, hath cured ſuch obſtinate Tumours, as Men either knew not what to make of, or what to do with them, of which ſkilful Phyſicians, to whom I gave it to make Tryal of in difficult caſes, can bear me witneſſe; though it ought ſufficiently to endear this Baſom to us both, that it was the Means of reſcuing Your Fair and Virtuous Siſter F. from

a dangerous Consumption. In outward application it is to be well warmed, and to be chafed into the part affected, which should be afterwards kept very warme, or else Lint dipped in it may be kept upon the place. Inwardly some drops of it may be given at any time, when the Stomach is not full; either rolled up with Sugar, or mingled with any convenient Vehicle. But as for the Particulars that concern the Preparation of this Balsome, You will find, those I can readily meet with among my loose Papers, annexed, with the Notes concerning *Ens Veneris*, to the end of this Essay.

The preparation
and Virtues of
*Essence of Harts
horn.*

And therefore I shall now proceed to mention the third Medicine, which You have often heard of, under the name of *Essence of Harts-horne*: but which is indeed onely the Simple, but well purified and Dephlegmed Spirit of it, And thoughh Men are pleased to imagine, by the Effects this Remedy often produces, that I have some Mysterious or elaborate way of preparing it, yet to deale ingenuously with You, the chief thing I have done to bring it into credit, is the teaching some Physicians and Apothecaries a safe and easie way of making it. For whereas before, those that went about to Distill it, commonly used, as the Apothecaries are wont to doe in what they make of the same Matter, Shavings or Raspings of Harts-Horne, and distilled it with a strong and naked Fire, the fugitive and subtile Spirits were wont to come over in that plenty, and with that impetuosity, as to break the Glasses to pieces, whereby Apothecaries, and even Chymists were discouraged from drawing the Spirit; and they not having it in their Shops, its Virtues remained unknown. Whereupon, considering that if it were onely broken on an Anvill into pieces of about the bignesse of ones little finger, besides, that this way of comminution would

would be far lesse chargeable than Rasping, the Fumes would not be driven out so fast: and considering too, that a violent Fire was requisite, not to distill the subtle Spirit, but to drive over the grosse and heavy Oyle, I thought it was needlesse to take pains to force that over, which not being (that I observed) used in Physick, would cost me further pains to separate it again: And therefore, trying to distill Harts-Horn, in naked Retorts, placed but in Sand, I found I could Distill two or three pound at a time, and obtain from each of them, almost, if not quite, all the Spirits and volatile Salt, which I afterwards separated from the reddish and lighter Oyl, and freed them from Phlegm and Feculencies by a couple of Rectifications, made in tall Glasses, and with very gentle Heats, (commonly of a Lamp-Furnace.) The Dose may be from eight, or ten Drops of the Spirit, or Grains of the Salt, to six times the quantity of either, in warm Beer, or any vehicle that is not acid except Milk. Finding it to be a Medicine of an attenuating, resolving, and Diaphoretical nature, and one that much resists Malignity, Putrefaction, and acid Humors (whence being mingled with spirit of Vinegar, and the like sour Juices, it destroys their Acidity,) I direct it (*præmissis Universalibus*) in Feavers, Coughs, Plurisies, Obstructions of the Spleen, Liver, or Womb, and principally in affections of the Brain, as stoppages of the Head, Feaverish *Deliriums*, and even in *Phrenetide*. And since I wrot a good part of this Essay, I had an Experiment of it in a Child, who being, by many violent Convulsion-fits, reduced to a desperate condition, was recovered by one Dose of five or six Drops of this Spirit that I sent it. It is true that I have another Medicine, that is more elaborate and costly, and more properly bears the name of *Essentia cornu Cervi*, which I
more

more value than this: But I cannot communicate that without prejudicing a third person, and an excellent Chymist who makes great advantage of it. But this I can tell you, that most of the Cures, for which my Preparation of Harts-horn hath had the good fortune to be esteemed, have been performed with the above described simple Spirit and Salt, with which some skilful Physicians and other ingenious persons, who had it from me, have within these few years saved so many Lives, that I am inclined to think, I have done no uselesse piece of Service, in bringing so happy a Medicine into request, especially with those that have skill and opportunity to make better use of it than I. But, *Pyrophilus*, I find I have detained you so long with so prolix a Mention of the three above-described Remedies, that I should think it requisite to make you a solemn Apology; but that I hope your Charity will as well invite You to pardon the Fault, as mine induced me to commit it.

CHAP. VII.

That Mechanicks and other Experimental Learning may teach how to lessen the charge of cures, by making more convenient Furnaces, demonstrated in diverse Particulars.

A Fourth way of lessening the Charges of Cures may be this; That whereas the dearness of very many Medicines proceeds from the Chargeableness of those Chymical Operations, whereby they are wont to be prepared, it is to be hoped that a greater measure of skill in Physiology, and other Experimental Learning, will suggest cheaper and better wayes of doing many things in Chymistry than are, as yet, usually practised.

And those thrifty Expedients, I conceive, may be of several kinds, of which I shall at present mention, and that but transiently, three or four.

And

And first, I doubt not but Chymists may be taught to make better Furnaces, for several purposes, than those that have been hitherto most used among them. For professed Chymists, having been for the most part unacquainted enough with many other parts of Learning, and particularly with the Mechanicks, their Contrivances of Furnaces and Vessels have been far enough from being as good, as knowledge in Mechanicks and dexterity in Contrivances might, and, I doubt not, hereafter will, supply them with; whether as to the saving of Fuel, or to the making the utmost use of the Heat afforded by the Fuel they do employ, or as to the intending Heat to the height, or as to the regulating Heat at pleasure.

It is somewhat wonderful, as well as pleasant, to see how many Vessels may be duely heated by one fire (perhaps no greater than common Distillers employ to heat one Vessel) if the Furnace be so contrived, as that the flame may be forced to passe in very crooked and winding Channels towards the Vent or Vents, and the Heat may be skilfully conveyed to the several parts of the Furnace, according to the Exigency of the work it is to do. And as for the intention of Heat, I remember I have had odde effects of it, by the contrivance of a certain Furnace, that held but very few Coals, and to which I used no Bellows. But though by this way I could vitrifie sometimes the very Crucibles, and thought possibly I could, with a slight Alteration, melt down the sides of the Furnace themselves, yet a Disciple of *Cornelius Drebell*, and a very credible person assured me, That he knew a way of Furnaces that was yet fitter to bring Heat to the *superlative* Degree, and that He himself, the Relator, could by the meer force of Fire in his Furnace, bring *Venetian Calk* to flow; which is more, I confesse, than ever I have been able

to do either in mine, or those of the Glasse-house. But Experience hath assured me, it is easie to make a Furnace give that heat as expeditiously enough, and in other respects very conveniently to *Cupel* both Gold and Silver, without the least help of Bellows. That also Furnaces may be so ordered, as that the heat may be better regulated, than That in our ordinary ones, I may elsewhere shew You cause to believe; and in the mean time I shall onely tell You, that I look upon the skill of intending and remitting heat at pleasure, and especially the being able to keep a gentle heat long and equal as a thing of much greater moment, both as to Physick and Philosophy, than Chymists are wont to think, (the powerful effects of constant and temperate heats, being as yet known to few save those that have made tryal of them.) And with Lamp-Furnaces well ordered, diverse things may be done in imitation of Nature; some friends of mine having, as several of them assure me, in such Furnaces brought Hen-Eggs to manifest Animation. That also Furnaces may be so built, as to save much of the Laborants wonted attendance on them, may appear by the obvious invention of *Athanors*, or Furnaces with Towers, wherein the Fire is for many Hours, (perhaps for twenty four, or forty eight) supplied with a competent proportion of Coals, without being able to burn much faster than it should. And that in many cases the labour of Blowing may be well spared, and the annoyance of Mineral Fumes in great part avoided, by an easie contrivance, is evident by those Furnaces which are blown by the help of a Pipe, drawing the Air, as they commonly speak, either at the top, as in *Glauber's* fourth Furnace, or at the bottom, or, for want of room, upwards, I have sometimes tryed. To which may be added, that the casting of the Matters to be prepared upon quick Coals, as *Glauber* prescribes

in that which he calls his first Furnace, is, in some cases, a cheap and expeditious way of preparing some Minerals, though his method of making Spirit of Salt in that Furnace would not succeed, according to his promise with me, and some of my Acquaintance. And there are other more commodious Contrivances, by casting some things upon the naked Fire, which invites me to expect, That there will be several good Expedients of employing the Fire to Chymical operations, that are not yet made use of, nor, perhaps, so much as dream'd of.

And as Furnaces, so the Vessels, that more immediately contain the Thing to be prepared, are questionless capable of being made more durable, and of being better contrived, than commonly they are. Good use may be made of those Earthen Retorts, that are commonly called *Glauber's* second Furnaces, in case they be made of Earth that will endure strong Fires, and in case there be a better way to keep in the Fumes, than that he proposes of melted Lead, which I have therefore often declined for another, as having found it liable to such inconveniences as I elsewhere declare.

But for Materials that are cheap, and to be distilled in quantity, as Woods, Harts-horn, &c. the way is not to be despised, and is, as we may elsewhere have occasion to shew, capable of improvement; though in some cases this kind of Vessel is inferiour to those tubulated Retorts, that were of old in use, and mentioned by *Basilius Valentinus*, and from which *Glauber* probably desum'd that which we have been speaking of. The utility of the way of sealing Glasses Hermetically, and of the Invention that now begins to be in request, of stopping the Bottles, that contain Corrosive and subtle Liquors with Glasse stopples, groun'd fit to their Necks, instead of Corks, together with some other things,

Glasse stopples
fittest for Cor-
sive Liquors.

not now to be mentioned, keep me that I scarce doubt but that if we could prevail with the Glasse-men, and the Potters, to make Vessels of Glasse and Earth exactly, according to directions, many things in Chymistrie might be done better and cheaper than now they are; and some things may be then done, that with the forms of Vessels now in use cannot be done at all. And if that be true which we find related in *Pliny*, and with some other Circumstances in *Dion Cassius*, of a more ingenious than fortunate man, who, about his time, was put to death for having made malleable Glasse: As the truth of that Story, if granted, would shew the retrieving that Invention, a thing not to be dispaired of; so he that could, now Chymistry is so cultivated, find again the way of making Glasse malleable, would be, in my Opinion, a very great Benefactor to Mankind, and would enable the *Virtuosi*, as well as the Chymists, to make several Experiments, which at present are scarce practicable: and some Chymists would perhaps think the Attempt more hopeful, if I tell them first, that I remember *Raymund Lully* expressly reckons it among three or four of the principal Virtues he ascribes to the Philosophers Stone, that it makes Glasse malleable; and then, that an expert Chymist seriously affirmed to me, that he met with an *Adeptus*, who, among other strange things, shewed him a piece of Glasse, which the Relator found, would endure and yeild to the Hammer. But what my own Opinion is concerning this matter, and what are the (uncommon) Inducements I have to be of it, I must not here declare.

And on this occasion, I remember I have seen an Instrument of Tin or Pewter, for the drawing of Spirit of Wine (which You know is one of the chargeablest things that belong to Chymistrie) so contrived, that whereas in the ordi-

nary way much time, and many rectifications are requisite to dephlegm Spirit of Wine; one Distillation in this Vessel will bring it over from Wine it self, so pure and flegmlesse, as to burn all away. And I remember, that the ancient French Chymist, in whose Laboratory I first saw one of these Instruments, told me, That it was invented, not by any great Alchymist or Mathematician, but by a needy *Parisian* Chirurgion. And now I speak of Spirit of Wine, I shall adde, That as the Charges of Chymistrie would be very much lessened, if such ardent Spirits could be had in plenty, and cheap; so I think it not improbable, that in divers places there may be found, by Persons well skill'd in the Nature of Fermentation, other Vegetable Substances far cheaper than Wine, from which an inflammable and Saline Sulphureous spirit, of the like virtue, for dissolving resinous Bodies, drawing Tinctures, &c. may be copiously obtained. For not onely, it is known, that Sider, Perry, and other Juices of Fruits will afford such a Spirit; and that most Grains, not very unctuous, as Barley, Wheat, &c. will do the like, but other Berries that grow wild, as those of Elder, will yeild a Vinous Liquor. And in the *Barbada's* they make a kind of Wine, even of Roots, (I mean their *Mobby*, which they make of Porato's; as I have also, for curiosity sake, made Bread of the same Roots:) nay, even from some sorts of Leaves, such a Liquor may be obtained. For I have observed Roses, well fermented, to yeild a good Spirit very strongly tasted, as well as inflammable. And as to the preparing of pure Spirit of Wine it self, I know wayes (and one of them cheap) that may exceedingly shorten the time, and pains of dephlegming it: but that being to be done otherwise, then by any peculiar contrivance of Furnaces or Glasses,

That inflammable Saline Sulphureous Spirits may be drawn from other Substances cheaper than Wine.

Glasses, I reserve it for a fitter place, in one of the following Essays.

Instances in divers particulars how the Naturalist may find cheaper wayes of heating the Chymists Furnaces.

And as more expedient and thrifty wayes, than the vulgar ones, of making Chymical Furnaces and Vessels, may be devised ; so it is to be hoped that a skilful Naturalist may find cheaper wayes of heating the Chymists Furnaces, or Distilling in his Vessels (either by finding combustible Materials, not formerly in use in the places where we work, or by making those already imployed fitter for use) by bringing them by some cheap alterations, either to give a greater, or a more durable Heat ; or to be lesse offensive by their smoak or smells; or else by discovering some cheap way of doing, in some cases, without Fire, what was wont to be done by it.

We see that in some places, especially here in England, where Char-coal was onely burnt in Furnaces, Pit-coal is substituted in its room. And at this day there are several of those that make *Aqua fortis* in great quantities, that Distill it with such Coals, which cost nothing neer so much as those made of Wood. And Experience hath informed me, that even in other sorts of Furnaces, the same Fuel may be imployed, provided the Barres of the Grates be set wider asunder, and a little Char-coal be mingled with it for the better kindling: And since of late years Pit-coal have been found in several places among us, where they were not formerly known to be, it seems not improbable, that many other Countries may afford Chymists, and the rest of their Inhabitants, the like advantage, if search were duely made, by boring of the Ground, by the observations of the Waters, and the Steams of places suspected, and by other wayes of inquiry that a skilful Man might direct. But because the abundant Smoak of Pit-coal uses to be very offensive, and the

the smaller Coales easily run thorough the Grates, and because of other inconveniences, there hath been a way found out of Charring these Coals, and thereby reducing them into coherent Masses, of a convenient bignesse and shape, and more dry and apt to kindle: And these, though quantity for quantity, their price be little inferiour to that of Char-coale; yet those that consume great proportions of Coales, tell me they find them almost as cheap again, in regard they will not onely last much longer, but give (especially near at hand) a far more intense heat. And therefore it must be a very useful thing to Chymists, to shew a way of Charring Sea-coales, without the help of those Pots, which make them of the price they now bear. And that it is not onely possible, but very easie, I could quickly shew You, if it would not prejudice an industrious Laborant, whose Profession being to make Chymical Medicines in quantity, obliges him to keep great and constant Fires, and did put him upon finding a way of charring Sea Coal, wherein it is, in about three hours or lesse, without Pots or Vessels, brought to Char-Coal; of which having, for Curiosity sake, made him take out some pieces, and cool them in my presence, I found them upon breaking to appear well charr'd, and much thereof in shew not unlike a Marchasite. And that which was very convenient in this Contrivance was, that whilest the Pit-Coal was Charring, it afforded him a very intense heat to melt or calcine the Minerals, he had occasion to expose to it: And he confest to me, that by this Method, he saved three parts in four of the Charges the keeping such great and constant Fires, with common Char-coal, would cost him. In *Holland* likewise, they have a way of Charring Pear, (which is a combustible Turfe, that they dig under Ground) and a skilful Distiller, that much employed it, commends it

Of charring
Coals, so that
while it charrs
it gives an in-
tense heat fit to
melt or calcine
Minerals.

Of charring
Pear,

to

to me, as a very good Fuel, even for Chymical Fires, which I therefore mention, because the way of charring Peat is not yet brought into several Countries, where Peat is digged up: and probably, it would be found in divers Regions, where it is yet unknown, if due search were made for it. To which I may adde, that it is not unlike, that some Countries may afford such combustible Materials fit for Chymical Furnaces, as have not, as yet, been so much as named by Mineralists: as I remember I have seen, and had, a sort of Coals, some of which looked like Marchasites, that burned clear with a good Flame, and had this convenient Quality for the Chymist's Use, that they were not apt, like the common Pit-coals, to stop the Grates with their Sindere, but burnt to whitish Ashes almost like Char-coal made of Wood, and yet gave so great a Heat, that an industrious Chymist of my Acquaintance, who kept many things constantly at work, found it worth while to have them brought him, above a dayes journey, on Horses backs.

But it is not impossible, that when men grow better Naturalists, they may find wayes, of exciting Heat, enough for many Chymical Operations, without the help of Fire, and consequently, without the consumption of Fuel. We find that by the Attrition of hard Bodies, considerable degrees of heat may be produced, not only, in combustible Materials, as Wood, and the like, (which would therefore be improper to be here insisted on;) but in others also, and particularly in Iron and Steel, one may by Attrition soon produce a smart Heat, as You may quickly try, by nimbly Filing a piece of Iron, with a rough File, or swiftly rubbing, though but a few Minutes, a thin piece of Steel against a Board. And whether some contrivance may not be found, by the help of cheap Engines moved by Water, or otherwise,

to produce a durable heat in Iron vessels, fit to digest in, we may elsewhere have further occasion to consider; But this is known, that from some succulent Plants a Liquor may be drawn, onely by exposing them in Glasses, purposely contrived, to the Beams of the Sun. And there is nothing more common, than for Chymists to make their Digestions by the warmth of Horse-dung, whereby they might also (as some Analagous trials incline me to think) conveniently enough Distill some fermented Liquors; especially if the way were improved by the skilful addition of Quick-Lime, and seasonable aspersions of Water. And I doubt not but many cheap Materials might, by a few Trials, be found, whereby portable digesting Furnaces, without Fire, (if I may so call them) might be made, without the ill smell and nastiness, which discommends the use of Horse-dung. For not onely we see, by what happens in the Spontaneous heating of Malt, and some other familiar substances, that probably most sorts of Grains and Berries, fit for Fermentation, may be brought to yield, for a good while, a Heat great enough to putrifie or digest with: but I have, several Years agoe, by many Trials found, that I could, by invironing Glasses with reffuse Hay, well pressed down, and equally wetted throughout, produce for divers dayes such a heat, as made me decline the employing of Horse-dung; and yet (which is the chief thing for which I mention this) the quantity of Hay was so small, that in all my Trials I found not, that the Hay did of it self, though kept close enough, take Fire, as else is usual in Ricks of Hay not sufficiently dried, where the Quantity, and consequently the Weight, that presses the lowermost parts close together, is considerable.

Of Digestion
and distillation
without fire.

But further, in divers Operations, where an actual Fire is requi-

Wayes of distilling Spirit of Urine.

Of distilling it with Lime without fermentation.

That so distilld it doth not coagulate Spirit of Wine, as in the usual distillation.

requisite, it may be hoped that knowing Men may discover wayes of saving much of the Fire, and making skill perform a great part of the wonted office of Heat. To obtain the Spirit of fresh Urine, You must Distill away near nine parts of ten, which will be but Flegm, before the Spirit or Volatile Salt will (and that scarce without a pretty strong heat) regularly rise. And there are several Chymists that to this day make use of no better way of Distilling Urine: but he that knows how Putrefaction opens many Bodies, may easily save himself the expence of so much Fire. For if You let Urine stand well stopped, for eight or ten Weeks, the Saline and spirituous parts will so extricate themselves, that the Spirits that before stayed behind the phlegm, will now, even with the gentlest heat, rise up first, and leave the Flegme behind. And on this occasion I shall teach You, what I do not know to have been mentioned by any Writer; namely, That even of fresh Urine, without Digestion or Putrefaction, I can, by a very cheap and easie way, make subtile and penetrant Spirit ascend, first, even in a gentle heat: And I am wont to do it onely by pouring Urine, how fresh soever, upon Quick-lime, till it swim some Fingers breadth above it, and then distilling it as soon as I please. But I did not find, upon many Trials, that this Spirit, though even without Rectification very strong and subtile, would Coagulate Spirit of Wine, like that of putrified and fermented Urine; though perhaps for diverse other purposes it may be more powerful.

And here I shall advertise You, that whereas I just now took notice, that there was a pretty strong Fire requisite to force up the Salt of unfermented Urine, out of that part, which, after the abstraction of the Flegm, remains of the consistence of Honey; trial hath informed me, That the volatile

volatile Salt may out of the thick Liquor be obtained, better
 and more pure, with ease, and with a scarce credibly small
 Heat; barely by tempering the Urinous Extract with a con-
 venient quantity of good Wood Ashes, whereby (for a reason
 elsewhere to be considered) the volatile part of the Salt of
 Urine, is so freed from the grosser substance, that with
 strange facility it will ascend fine and white, to the top of
 very tall Glasses. But of the differing Preparation of Urine, Of the power
of good Men-
struums in faci-
litating distil-
lation.
 more perhaps elsewhere. I now proceed to tell You, that I
 think it not unlikely, that even Bodies, which are more
 grosse and sluggish, may, by the Affusion of such *Menstruums*,
 as humane Industrie may find out, be far more easily, either,
 volatiliz'd or unlockt, than common Chymists are wont to
 think. For I know a Liquor, not very rare among Chy-
 mists, by whose help I have, often enough, distill'd Spirit of
 Nitre (whose Distillation requires much about the same vi-
 olence of Fire with that of *Aqua fortis*) even in a mode-
 rate heat of Sand, and without a naked fire. This Spirit may
 easily enough be brought over, even in a Head and Body:
 and for a Wager, I could obtain a little of it without any
 Fire or outward heat at all. And I remember also, that have-
 ing once digested a certain *Menstruum*, for a very short time,
 upon crude *Antimony*, and abstracted it, in a very gentle heat
 of Sand; the Liquor not onely brought over some of the
Antimony in the form of red Flowers, swimming in it, and
 united other parts of the Mineral, with it self, in the trans-
 parent Liquor; but the gentle heat rais'd to the top of the
 Retort divers little Masses of a Substance, that were very
 transparent, like *Amber*, which were inflammable, and
 smelt, and burnt blew, just like common *Sulphur*: And yet
 the *Menstruum*, which was easily again recoverable
 from the *Antimony* was no strong Corrosive, tasting,

before it was poured on, not much unlike good Vinegar.

But besides all the wayes above mentioned of saving the Chymist either Time, or Fire, or Labour; I despair not that divers others, yet unthought on, will be in time found out by the Industrie of skilful Men, taking notice of the nature of things, and applying them to Chymical uses: as we see, that by Amalgamations with *Mercury*, the calcination of Gold and Silver, may be much easier performed, than by a long violence of Fire. And (if it be true, what *Helmont* and *Paracelsus* tell us, of their immortal Liquor *Alkabeſt*) Medicines far nobler, and otherwise more difficult to make, than those hitherto in use among the Chymists, may be prepared with greater ease, and expedition, and with far lesse expence of Fire, than the nature of the Metals, and other Concretes to be opened by it, would let a vulgar Chymist suspect. However I see no great cause to doubt, that there may be *Menstruums* found that will much facilitate difficult Operations, since not to mention again the Liquor I lately told You would work such a change on Nitre (and, I might have added, on some other compact Bodies,) it is very like, there may be *Menstruums* found, that will not be so spoiled by a single Operation, made with them, as our vulgar Saline Spirits are wont to be. For I have tryed that a *Menstruum*, made by the bare Distillation of good Verdigrease, will not onely draw, as I have formerly told You, a Tincture of Glasse of *Antimony*, or perform some other like Operation for once, but being draw'd off from the dissolved body, or the Extraction, will again serve, more than once, for the like Operation upon fresh Materials.

The fifth, and last way, *Pyrophilus*, that I intend to mention, of lessening Chymical Expences, is, That the Naturalists may probably find out wayes of preserving some Chymical

That the calcination of Gold is facilitated by Amalgamations with *Mercury*.

The power of Verdigrease distilled in drawing tinctures of Glasse of *Antimony*, &c.

mical Medicines, either longer or better than those wayes that are usual. But of this preservation of Bodies being like, as I formerly intimated, to have elsewhere further occasion to Treat; I shall now onely say, That the purified Juices, liquid Extracts, *Robs*, and other soft Medicaments, made of Plants, may be Conserv'd far cheaper, as well as better, than with Sugar (which clogs most mens Stomacks, and otherwise disagrees with many Constitutions) in case *Helmont* say true, where he tels us, That for a small piece of Money he can, for I know not how long, preserve whole Barrels of Liquor. And a way he intimates, of fuming liquors with *Sulphur*, I have already told You, is a very good way of keeping them uncorrupted; provided, that (though he prescribes it not) they be six or seven several times (seldomer or oftner, according to the quantity or nature of the Liquor) well impregnated with that imbalming Smoak; to which purpose it is convenient to have two Vessels, to pour from one to the other, that whilst the Liquor is shaking in the one, the other may be well filled with Smoak: whereto I shall onely subjoin this Secret, which a friend of mine practises, in preserving the fumigated Juices of Herbs (as I elsewhere inform You, I do to preserve other things) with a successe that I have somewhat wondred at; which consists, in adding to the thick Liquor to be preserved, a due, but small proportion of the white *Coagulum*, (which I often elsewhere mention) made of the pure Spirits of Wine and Urine.

That the Naturalist may find our wayes to preserve Medicines longer & better than is usual.

Of fuming Liquors with *Sulphur*.

And adding a little of the white *Coagulum* made of the pure Spirits of Wine and Urine.

But I have made this Excursion too prolix, and therefore I shall onely adde as a general admonition, That we are not, by the common practice of vulgar Chymists to estimate what knowing Naturalists, skilled in Mechanical Contrivances, may be able in time to do, towards the making of Chymical

call Remedies, as well more *cheap* as more *effectual*: and indeed, to make them more *effectual*, is the best way to make them more *cheap*.

That the most principal way of lessening the charge of Cures would be the finding out new and more effectual remedies.

For, *Pyrophilus*, after all the wayes that I have mentioned, whereby the Charges of the *Therapeutical* part of Physick may be lessened; I must advertise You, both, That I make no doubt but that there may be others found, which either through want of skill or leisure I have pretermitted, and that I have not yet named the principal of all; which is, That the deep insight into Natural Philosophy may qualify him that hath it, by several wayes, and especially by discovering the true Causes and Seats of Diseases, to find out such generous and effectual Remedies, (whether Specificks, or more universal *Arcana*) as by quickly freeing the Patient from his Disease, may exempt him from needing either much Physick from the Apothecary, or many chargeable Visits from the Doctor, or Chirurgeon. Thus the rich Merchant I mentioned, in one of the former Essayes, to have been freed, by a Specifick, from the Gout; and the Young Lady cured of her Fistula's, by the infusion of *Millepedes*; might well, in the ordinary way, have spent, even supposing them thrifty, an hundred times more upon Physicians and Physick, than the potent and nimble Remedies, whereby they were so happily recovered, cost them.

[To which I shall adde, by way of Confirmation, both of this, and of what I lately told You, concerning the Efficacie that may be, even in slightly prepared Simples, what I came to learn, since the writing of the former part of this Essay; namely, that a Young Lady, who (though of great Birth, is yet of far greater Beauty and virtue, whom I presume I need not name to You) having been long troubled with an almost hereditarie Epileptical Distemper, and after

having

having been wearied by courses of Physick prescribed her by the Famousst Doctours that could be procured, without at all mending, but rather growing worse, so that sometimes she would have, in one day, eight or ten of such dismal Fits, as You and I have seen her in; was cured onely by the Powder of true *Misseltoe* of the Oak, given as much as would lie upon a Six-pence, early in the morning, in black Cherry-Water, or even in Beer, for some dayes neer the full Moon. And I am assured, partly by the Patient her self, and partly by those that gave her the Medicine, That though it had scarce any other sensible Operation upon Her, and did not make her sickish, especially when she slept upon it; Yet after the first day she took it, she never had but one Fit. And this Remedie an ancient Gentleman, who, being casually present when she suddenly fell down as dead, gave it her, professed himself to have constantly cured that disease with it, when he could procure the right Simple, which is here exceeding scarce. And what further Experiment some Friends of Yours have succesfully made, I may elsewhere have occasion to relate.]

To which I shall onely adde, That one of the Skillfullest Methodists I ever knew, having had much adoe to preserve a Young Cousen of Yours from a very dangerous Cough, by a long Course of Physick; the Partie, at the beginning of the next Winter, falling into a Relapse more threatening than the first Disease, was rescued from it in two or three dayes, by not many more takings of a Specifick sent her, made of nothing else but Harts-horn prepared as I lately taught You. And if such slight Medicines, consisting, each of them, but of a single Simple, not elaborately prepared, may sometimes (for I say not alwaies) performe such speedy Cures even in Chronical Distempers; what may not be hoped from the *Arcana*
majora

An history of a
radicated Epi-
leptic that was
cured by the
powder of *Mis-
seltoe* of the
Oak.

majora (such as *Paracelsus's Landanum*, so praised by *Opirinus* himself, and *Butler's Driff*, so extoll'd by *Helmont*) when the skilfullest Preparations of the noblest Simples shall come to be known by Learned and judicious men, intelligent in the *Theory* of Physick, and especially versed in the History of Diseases? And though *Riverius* were none of the greatest Naturalists, or, at least, Chymists; yet if in his Observations, and elsewhere, he flatter not his own *Febrifugum*, How many Patients did that one Specifick rescue from Quartans, that would else probably have prov'd as Chargeable as Tedious?

But, *Pyrophilus*, having said so much, that I fear You have thought it tedious, to shew that a Naturalist, skill'd in Chymistrie and the Mechanics, may assist the Physician to make his cures lesse Chargeable; it is high time, that after so long an Excursion, I proceed to consider in what other particulars He may be a Benefactor to the Physicians Art.

CHAP. VIII.

Fifthly, then, that the Naturalists skill may improve the *Pharmaceutical* preparations of Simples, by several wayes partly touched already; and partly to be, either, added or further treated of; the great variety of new Remedies, wherewith the Laboratories of Chymists have furnished the Shops of Apothecaries, may convincingly inform you. To which I must take the liberty to add (and that upon serious Consideration? That the *Chymicall Preparations, hitherto common in Dispensatories, are, as to the Generality of them, far enough from being the most Dextrous, or Noble, that can be devised*: For our Vulgar Chymistry (to which our Shops owe their venall *Spagyricall Remedies*) is as yet very incompleat, affording us rather a Collection, of loose and scattered (and many of them but casuall) Experiments, than an Art duely superstru'd upon Principles and Notions, emergent from severe and competent Inductions, as we have elsewhere endeavour'd more particularly, to manifest: And therefore till the Principles of Chymistry be better known, and more solidly establish'd, we must expect no other, than that, very few vulgar Chymicall Remedies should be of the Noblest sort; and that in the preparation of many others, considerable errors should be wont to passe unheeded: And faults gross enough, be apt to be mistakenly committed. But of this Subject, we may elsewhere have divers occasions to entertain You; and our single Essay, of the *Chymicall Distinctions of Salts*, will perhaps discover to You no small mistakes

Other proofs
that the Naturalists skill may
improve the
Pharmaceutical
preparation of
Simples.

mistakes, in the preparation of divers applauded Vulgar Medicines. For it is not the Elaboratenesse, but the Skillfulness of preparations, that produceth the Noble Remedies; and a few Teeming Principles well knowne and applied, will enable a Man with ease to make better Remedies, than a great many Furnaces and Glasses, though never so well contriv'd, and though very usefull in their kind. To make this out in some measure, I shall name some such Instances, as may withall confirme what I formerly delivered in this Essay, touching the possibility and usefulness of Correcting either poisonous, or otherwise very noxious Simples. I never knew *Opium* so much Corrected by Saffron, Cinnamon, and other Aromaticall and Cordiall Drugs (wherewith it is wont to be made up into *Laudanum*) nor by the most redious tortures of *Vulcan*, as I have knowne it by being a while Digested in Wine, impregnated with nothing but the weight of the *Opium* of pure Salt of *Tartar*, as wee elsewhere more fully declare. (A much nobler *Laudanum* may be made by adding to the *Opium*, instead of the Salt, two or three appropriated Simples, and by due Fermentations and Digestions of them with it.) And for that violent Vomiting-Medicine, by Chymists flatteringly enough, called *Mercurius Vita*, a whole Pound of Cordiall Conserves, or Liquors, will not so well moderate its evacuating force, as the keeping it continually stirring in a flattish and well glaz'd earthen Vessell, placed over a Chafing-dish of Coales till it emit no more fumes, but grow of a grayish Colour: which I am very credibly informed to be the Preparation of *Merc: Vitapurgans*; oftentimes mentioned and commended by the famous Practitioner *Riverius*, in his Observations. A not unlike, but far more sudden, Correction of that active Powder,

Of the best
wayes to correct
Opium.

Of the best way
of correcting of
Mercurius Vita.

der, I elfewhere teach. And as for thofe Operative Minerals, *Quick-filver*, and *Antimony*, though long Experience of their churlifh and untractable Nature have made many of the waryer Physicians and Chymiffts, shy to meddle with either of them fingle: Yet thefe Concretes, which feem fo Incorrigible, may, by being barely (in the gradual Diffillation, of Butter of *Antimony*) fublim'd up together in a *Cinnaber*, and then that *Cinnaber*, fix or feven times refublim'd *per fe*, be united into a Medicine, that not onely is not wont to worke, either upwards or downwards, but of which I have knowne fafely taken, even in fubftance, to the Dofe of many Grains; and a few Drachmes of which, infus'd in a Pound or two of Wine, hath made it of that inoffenfive Efficacy (taken, in the quantity of a Spoonfull or two, dayly upon an empty ftomach) That, if it ftill fucceed as well as we have obferved it two or three times to do; we may think that our having thus acquainted You with the Virtue of this unlikely Remedy, (though we have alfo met with it, even in Printed Books) may make you amends for all the reft of this tedious Difcourfe. I once knew a flight (but altogether new and tedious, as well as Philofophical) Preparation of Salt of *Tartar*, Correct and Tame fuch Poyfons, as ten times the quantity of the higheft Vulgar Antidotes, or Cordialls, would (I was confident) fcarce have fo much as weakened: And I have known by the fame prepared Salt, dextroufly Speciflicated by Simples, the Virtues of fome Vegetables fo exalted, That, without any *Cathartique* or *Emetique* Operation, they have (if many Patients, of whom I had cafual opportunities to enquire of the Effects of thofe Remedies upon them, do not mifinform me) proved more effectually in Taming divers ftub-

An excellent
Medicine made
of thofe chur-
liff Minerals
Quick-filver
and *Antimony*.

born Diseases, then *Crocus Metallorum*, *Mercurius Vitæ*, (as it is abusively called) and those other dangerous Remedies, which make the Vulgar wont to say of Chymists, that they quickly either cure their Patients or kill them. And to let you see, *Pyrophilus*, by one plaine, and yet noble instance, That the knowledge of the Specifick Qualities of Things, skilfully applyed to preparations, may performe, with ease, what neither costly Materials, nor elaborate Processes are able to effect; Give me leave to inform You: That, whereas, Chymists and Physicians have not been able by infusing the true Glasse of *Antimony* (made *per se*) in Spirit of Wine, or the richest Cordiall Liquors nor yet by torturing it after severall tedious and artificiall manners, to deprive it of its *Emetique* quality; That Vomitive faculty, of *Antimoniall* Glasse, may be Corrected by so slight a way, as that of Digesting it with pure Spirit of Vinegar, till the *Menstruum* be highly ting'd. For if you gently abstract all the Liquor, and on the remaining yellow or red Powder, you Digest well dephlegmated Spirit of Wine; You may after a while obtaine a Noble and not *Emetique* Tincture: Of which though *Basilus Valentinus* prescribes but five or six Drops for a Dose, yet a *Domestique* of mine having, out of curiosity, taken to the quantity of thirty Drops at a Time, he found it not at all Vomitive. And this Tincture we the rather mention, Because, not only *Basilus Valentinus*, but other skillfull Persons, highly extoll it for severall Diseases.

Wayes to take
away the Vomitive
faculty of
Antimonial
Glasse.

See his *Curvus*
Triumphatus
Antimoni

And let me adde, *Pyrophilus*, (and be pleased to marke well what I tell you) That by bare reiterated Digestions, and Fermentations, there may be prepared, out of many Vegetables, Saline and Sulphureous Effences (whose

(whose Bulke is exceeding small, in proportion to the Concretes whence they are Extracted) which will keep many Years, as I can shew you some above three Years old, and contain more of the *Crafsis* (if I may so call it) of the Simple, than the Vulgar Vegetable Waters, Spirits, Extracts, or Salts, hitherto extant in Laboratories and Shops. But there is so great a length of Time required, to the preparation of these Efficacious Juices, That my ambulatory condition of Life, hath not allowed me to furnish my selfe with many of them.

And, *Pyrophilus*, if You will not dis-believe a Person for whom You have so just an esteem, as You have for that Ingenious, and Experienced, *Monsieur L. F.* who was the French Kings Chymist, when You knew him at *Paris*; I can present You with a yet Nobler instance, to perswade You; That, if skill be not wanting, a single Herbe, without any violence of Fire, may, by other wayes than are in use among Chymists, be easily enough brought to afford Medicine, endowed with some Nobler Virtues than any of the most compounded, costly, and elaborate Medicines, whether Minerals or others, that are to be met with among Vulgar Chymists. This Efficacious part of the Plant, whence it is obtained, *Paracelsus* calls the *Primum Ens* of the Plant that yeilds it; But though, indeed, I have found the way of preparing it much plainer, and better delivered, than is usuall in his Writings, at the end of his Booke *De Renovazione & Restauratione*: Yet I freely acknowledge, That I should scarce have thought it worth the Tryall, if it had not been for what the Experienc'd Chymist above-mentioned, affirmed to me, upon his own Observations, concerning it,

z 3

partly

A new and excellent way to get the *Primum Ens*, or essence, of some Vegetables.

partly, because I am not wont to be forward, so much as to try long Processes upon *Paracelsus's* credit, and partly, because what he calls *Sal Solutum* seemed to me somewhat ambiguous; since in the same Page teaching to draw the *Ens primum* of Gold and *Antimony*, he makes not use of Sea-Salt but of (a Salt of an incomparably higher Nature) his *Sal Circulatum*; and in the Proceſſe immediately preceding ours, to make the *Ens primum* of *Emeralds*, he prescribes the Calcining them in *Sale Soluta*, which agrees far better with his *Sal Circulatum*, than with any Solution of Sea-Salt, which seems very unlikely to be able to Calcine, and, as he says it must, dissolve *Emeralds*. But the way, that our French Chymist told me he used, was in Substance this: Gather, in a convenient season and time of Day, Baulm for instance, or some other fit Herb, (for experience hath taught, both him and me, that all Herbs are not fit, by this way, to be reduced into Liquors) and having beaten it well, in a Marble-Mortar, to a soft mash, placed in a Bolt head Hermetically sealed, to Digest forty dayes in a Dunghill or some analogous heat; then, opening the Vessell, take out the Matter, which will be far more Liquid than before, from which, having separated the grosser parts, You must Digest it in a gentle Bath, that the yet remaining grosser parts may subside; to which, being filtrated You must, according to him, (for I find not that *Paracelsus* requires it) joyn the fixed Salt of the grosser parts above mentioned, dry'd and calcin'd. To this prepared Liquor, You must adde equall parts of the Liquor of good Sea Salt well purified, and then melted, and suffered to run *Per Delliquium*: This Liquor, being also sealed up in a convenient Glasse, must be exposed to the Sunne for about six Weeks;

Weeks; at the end of which time there will swim at the top of it, the *Primum Ens* of the Plant in a Liquid form, transparent, and either green or red, or, perhaps, of some other Colour according to the Nature of the Plant. And though *Paracelsus* prescribes but Celandine, and Baulm, to be used, Yet having enquired of our Chymists, he told me, he had made such *Prima Entia* of *Scrophularia*, and, as I remember, of one or two other Herbes. But that which makes me thus, particularly, take notice of these kind of Medicines, is, That not only *Paracelsus* ascribes to the *Primum Ens* of Baulm, (or Celandine) the power of renovating them that use so much of it in good Wine as will give it a Tincture, early every Morning; till, first of all the Nailes of their Fingers, then those of their Toes, afterwards their Hair, and Teeth, fall off, and lastly, the Skin be dried and exchanged for a new one: But Your ingenious acquaintance assured me severall times, and once, in the presence of a famous Physician, and another *Virtuoso*, to whom he appealed, as knowing the truth of what he said; That an intimate Friend of his, whom he named to me, having, after the above mentioned manner, prepared the *Primum Ens* of Baulm, to satisfie himselfe the better of its Effects, made the Tryal upon himselfe, and took of it, according to the Prescription, for about a Fortnight: Long before which his Nailes, both of Hands and Feet, began to loosen themselves from the Skin, (but without any pain) which at length falling off, of their own accord, this Gentleman keeps yet by him in a Box for a rarity; but would not pursue the Tryall any further, being satisfied with what he had found, and being in no need of such Physick. But having given of the same Medicated Wine, for ten or twelve

The Influence
of these *prima*
Entia to cause
Renovation or
rejuvenescence.

twelve Dayes, to a Woman that served in his house, and was neere seventy yeares of Age, without letting her know, what he expected it should do. Her *Purgationi Menstrue* came upon her againe in a sufficiently great quantity to fright in; her so much, that he durst prosecute the Experiment no further. And when I asked, why he made no tryall upon Beasts: It was answered, that though he had but little of the Medicine, yet he put apart an old Hen, and moystning her food with some drops of it for a weeke, about the sixth day she began to moult her Feathers by degrees, till she became stark naked: but before a fortnight was past she began to regain others, which when they were come to their full growth, appeared fairer, and better coloured then the first: And he added, That, besides that her Crest was raised, she also laid more Egges, then she was wont. And as to the *Primum Ens* of the greater *Scrophularia*, by the Relater himself, though he ascribed not to it any renovating power, as to that of Balme or Celandine; yet he assured me, he had found it ennobled, by other great and extraordinary Virtues. But of this kind of preparation, I might ere now possibly, have been able to give You a better account, if in my tryalls about them, I had not met with some unhappy accidents, which I hope my next attempts will escape: which if they do, I may possibly, with an account of them, send You one of some attempts to prepare the like Medicines another and shorter way, together with a consideration, whether *Paracelsus* and others deservedly call such accidents as the above-mentioned change of Nalles, Hair, and even of Teeth, a reall renovation or rejuvenescence.]

It is likewise a way of preparation, differing enough from those that are common among Chymists, which *Helmont* (as he

he saies out of commiseration to the sick) delivers, where he reaches that which he calls the *Via Media* of making the *Elixir Proprietatis*, of which he gives us this commendation; *Hoc medicamine tam Quartanam, quàm continuam statim absolvi. Adcò ut qui noctu susceperat sacrosanctum viaticum, & olei extremam unctionem, me in prandio convivam circa lectum habuerit.* And though many think, that he has rather fraudulently than rightly set the process down; yet Experience has invited me to absolve him in this particular. (Though I must tell You, That because a languid Heat is not sufficient to make a Spirituous liquor ascend, and circulate as he requires; tis not every Chymist that will, especially in his first trials, avoid the breaking of the Glasses, or at least the burning of the materials, to which accidents this preparation is very obnoxious, if it be not as well watchfully as skilfully made.) And though for my part I have scarce us'd this *Elixir* but as a Cordial; yet I know some very expert Physicians, that have given it with great successe in divers difficult cases, and particularly a Friend of the younger *Helmonts*, gives it so successtully, that partly his Patients, and partly others that have try'd it, have sometimes taken of him, at a great rate, whole Pounds in a Year or two; and yet I know by his own confession, that besides the skill he imployes in making it dexterously, he adds nothing but one Ingredient, to which I confesse, I am not apt to ascribe any considerable part of the efficacy of the Medicine; which when made, he sometimes perfumes by cohobations with Musk, and Amber.

In tractatulo
cui titulus sequun-
tur *Quaedam*
Imperfectiora.

Of Helm. Via
media of Elixir
Proprietatis.

and the perfume
ing it with
Musk and Am-
ber.

And, *Pyrophilus*, that You may not wonder, that I, who think much of *Helmonts* Theory scarce intelligible, & take great exceptions at many things in his writings, should yet now and then commend Medicines upon his Authority, I

A a

must

A Commem-
oration of Hel-
monts Medi-
cines.

must here confesse to you once for all, that (always excepting his extravagant piece, *De magnetica vulnerum curatione*.) I have not seen cause to disregard many things he delivers, as matters of fact, provided they be rightly understood; having not found him forward to praise Remedies without cause, though he seem to do it sometimes without measure, and having more than once, either known, or even had considerable effects of Medicines he commends, which one of the happiest Practitioners I have met with, and one not lavish in extolling Chymical Remedies has solemnly assur'd me, he has generally, though not alwayes, found more then ordinarily effectual. And upon occasion of this odde preparation of the *Elixir Proprietatis*, I shall adde that, Since Experience shews us, by what is daily done in Chymical Laboratories, that upon the operation of the fire upon several Concretes, substances of Nature oftentimes very differing both from the body that afforded them, and from one another, may be obtain'd; as the Oyles, and fixt Salts even of cold Plants, or hot; Since also, by the mixture of active Bodies new Concretes, endow'd with new qualities, may be produced; as we see that *Saccharum Saturni* emergeth from the conjunction of Lead, with the Acid Salt, distill'd Vinegar, and since to the same Concrete, according to the differing manners, after which tis handled, may acquire differing Qualities, as is clear in the various Medicines, afforded us by Quick-silver, & by Antimony, according as each of them is order'd; I cannot but think, that if Chymistry did no more then assist us, by the resolution of Bodies, to extricate their more active parts, and partly by such resolutions, and partly by associating bodies together, to alter the former texture of Natures Productions, or present us with new Concretes of new Textures; by this very means

means, if men want not Curiosity, and Industry to vary and prosecute experiments, there must necessarily arise such a store of new and active Medicines, that in all probability, many of them will be found endow'd with such Virtue, as have not been, at least in that degree, met with in the usual Medicines, whether simple or compound, to be bought in Apothecaries shops; and consequently, even without any notable discovery, or improvement of Principles, Chymists, (even as matters now stand with them) may considerably add to the Pharmaceutical part of Physick. But if the Operations of Chymistry were seriously enquir'd into, and thoroughly understood, I make little doubt, but by a skilful application of them, and especially by a *series* of them, in a rational and orderly way, succeeding one another, there may be found out a great many preparations of Remedies, both very differing from the common ones, and far more noble than they. And to make this seem probable, I need but repeat some of the examples formerly mentioned; To which I shall add now, that Experience has inform'd me there is a way, whereby firmer consistent substances, belonging to the bodies of Animals, may without the addition of any extraneous Matter, and without any violence of heat, be reduced almost totally into liquor, and if I much misremember not, these Liquors without any violence of heat, afford their Spirituous & Saline parts, in a very gentle heat, and that before their Flegme. And I must peculiarly inculcate this, That if we had but a few potent Menstruums, to dissolve and unlock bodies with, I scarce know what might not be done in Chymistry. But when I speak of noble Menstruums, I mean not such as work like the generality of Corrosives, and the like Acid or Saline Liquors, which work but upon few kinds of bodies, and soon coagulate, or exantlate themselves

*Of the power of
Chymistry.*

*Of the power of
Noble Men-
struums parti-
cularly.*

selves by working, and thereby come unfit for future operations; but I mean such as either are separable with all their efficacy from the dissolv'd Body, as is said of the *Alkahest*, or such Saline or other piercing Liquors, as not being precisely either Acid, Urinous, or Alcalizate can dissolve a great variety of Concretes, without having their Vertue, I say not impair'd, but destroyed thereby; and unlock Mineral bodies, far more then vulgar Menstruums, (as for instance by volatilizing them, or else making them irreducible, or working the like grand changes in them;) and if it be not quite separated from the dissolv'd Body, is yet so friendly to Humane Nature, as to be free from either fretting, or other such dangerous and offensive Qualities, and rather to be of itself a powerful Medicine. I should therefore exhort both You, and such other ingenious persons, as with the advancement of Chymistry, and Physick, (I might possibly adde Natural Philosophy too) to apply their Chymical attempts, chiefly to the finding out of Noble Menstruums, for by being possessor but of one of these, a man may be able to doe a great number of things, that otherwise are not performed. As one of our ordinary Goldsmiths, by the knowledge he hath of *Aqua fortis*, can make many useful Experiments about Silver and Gold, that before that Menstruum was found out, all of his Profession in the world, were never able in many ages to compass. Nor do I much wonder at that advise, which *Helmont* gives those that aim at the improvement of Physick, in these words: *Quod si ad istud ignis arcanum non pertingat is* (he was speaking of a prodigious, not to say incredible Liquor) *discite saltem, salem Tartari reddere volatilem, ut huius medio vestras solutiones perficiatis. Qui etsi sua soluta, an aticè homogenea deserat, digestus in nobis illorum tamen aliquot vires mutuatus est, quos intra desert, plurimorum*

*Helm. de febr.
cap. 5. num. 26.*

metallorum

marborum demittrices. For concerning this Salt, he not only elsewhere saies, *Dicam saltem pro ingenuis, quod Spiritus Salis Tartari, si unicornu, argentum, hydrargyrum, lapides cancrorū, vel aliquod è simplicibus dissolverit, nedum febrim, sed & plures affatim morbos sanat, &c.* But in another place he gives us, together with some account of its way of working, this great and comprehensive commendation of it. *Mirum sanè, saies he; quantum sal Tartari, vel unicum, volatile factum, non praestiterit: Nam omnem è venis amurcam detergit & obstruentium contumaciam, dispergitq; apostematum suscepta conciliabula. De hoc Salis (& non olei) spiritu, verum est illud Paracelsi, quod quocunq; non attigerit vix alius potentior perveniet.* These passages I should not think worth transcribing and laying together, but I find that besides the concurrent testimonies of *Helmont, Paracelsus, and Basilins* in praise of this Salt, the generality of the more inquisitive Chymists, without excepting the more sober and judicious, do, by the various and painful, though fruitlesse attempts they have made to Volatilize Salt of Tartar, conspire in acknowledging it a thing highly worth labouring for; nor doe I for my part see (whatever some say to the contrary, and however I have indeed found it more difficult, then perhaps a Novice in Chymistry would think) it should be impossible, for I have more than once with ease enough, made Gold it self volatile, though it be confessed to be the fixest body in the World, and consequently more fixt then Salt of Tartar, which in an open vessel, may be in time made to fly away by a vehement fire; And I have likewise by an unusual Method, that I have elsewhere deliver'd, more than once obtained from a mixture of crude Tartar, and two or three Mineral bodies good store of true Volatile Salt, which I could see no just cause not to think afforded by the Tartar.

But

Helm. de febr. c. 17. vers. finem.

Helm. de schol. Humorista. pass. decept. c. 2. num. 89.

The power of Salt Tartari Volatilizd.

Of the possibility of Volatilizing it.

But I must confess this may be rather a volatile Salt of Tartar, than Salt (that is Alkali) of Tartar made volatile, and therefore the principal thing I mention it for, is to shew you that Tartar it self, by an unusual way of management, may be brought to afford an unusual kind of Salt. But this I can tell you, that an ingenious acquaintance of mine, whom notwithstanding my wonted distrusts of Chymists, I durst credit, affirm'd to me, that he had himself seen a true and real *Sal Tartari volatile*, made of Alkali of Tartar, and had seen strang things done with it, insomuch that he believed most of the things, that *Helmont* delivers of it. For my part I am inclin'd to think, that Salt of Tartar may be made volatile, (whether in the form of a Sublimate or a Liqueur) by more wayes than one, though not all of them neer equally good: & whereas one of the best (if not the very best) of the wayes of volatilizing it, seems to do it principally with Spirit of Wine, and the great difficulty of that way consists in bringing this Spirit to associate with the Salt: I have seen Salt of Tartar of my own, brought to that passe which great Virtuosi have long in vain attempted to bring it unto, namely, to flow readily upon a red hot Iron, and also to take fire, & burn with a conspicuous flame, besides that when it had been dryed by a smart fire, to drive away any parts that did not firmly adhere to it, it would yet readily dissolve in high rectify'd Spirit of Wine, which you know Salt of Tartar will not otherwise do; not to mention the change of its Alcalizate tast, and other lesser alterations, but what I can farther say of this matter, I must not declare in this place.

And *Pyro*. That you may not be as many other Virtuosi, discourag'd from labouring for noble Menstruums, by the confident perswasion of many, who believe *Angelus Sala* & *Guntherus Billychius* (whom I deny not to have been Learn-

ed Men, do not take to have been great Masters of Chymical *Arcana*) fit to determine with authority, what can, and what cannot be done by Chymistry, least I say You should be, by such mens inconsiderate severity, brought to despair of ever seeing any noble Menstruum, that is not sharp to the taste, nor of any of the three peculiar kinds of Saline Liquor. (Acid, as *Aqua fortis*; Urinous, as the Spirits of blood, Urine, and other Animal substances, nor Alcalizate, as Oyl of Tartar *per deliquium*) I shall assure you, that to my own knowledge there is in the world a kind of Menstruum, that consists of a pure ChrySTALLINE substance, that is made by the fire, and as truly Saline as Salt of Tartar it self, which strange Salt, though well purified, and readily dissoluble, as well in dephlegmed Spirits of Wine, as common Water, and though it be totally volatile (whence you may guesse of how Saline a nature it is) and also be either way reducible to a noble Menstruum, does really tast sweet; I mean not in the Chymical sense, by want of sownesse (as when they say that the *Calces* of corroded and precipitated things are dulcified by frequent ablutions) but by a positive sweetness. And whereas the vulgar Saline Menstruums, (which alone seem to have been known to *Sala & Billychius*) are so speciflicated, if I may so expresse it, that what an Acid Menstruum dissolves, an Alcalizate, or an Urinous will precipitate, & *à converso*; And whichsoever you choose of these three sorts of Menstruums, one of the other two will disarm and destroy it. I have found by tryal, not onely that a red Tincture of Glasse of Antimony, being drawn with a Menstruum that was but a degree to this Liquor, I could not precipitate it like our common Tinctures, either with Spirit of Urine, or an Alcalizate Solution. But that (which is farre more considerable) though it would readily mix with Acid Spirits

That there may be other Menstruums besides such as are Acid, Urinous, or Alcalizate.

How these several disarm and destroy one another, and what an Acid Menstruum dissolves, an Urinous or Alcalizate doth precipitate.

Of a Menstruum like to all these.

Spirits, as Oyl of Vitriol, with Volatile and Urinous Spirits, as Spirits of Urine it self, and with Alcalizate Solutions; yet would neither of these three make any Ebullition at all with it, or seem to work at all upon it. But of such matters no more at present.]

CHAP. IX.

That Chymistry
it self (much
more Physiology)
is capable of af-
fording a new
and better Me-
thodus meden-
di.

YOU will perhaps expect, *Pyrophilus*, that, Treating of the advantages that may accrew to the Therapeutical part of Physick, from a more accurate knowledge of Natural Philosophy; I should tell you with the Chymist, that Chymistry it self, and much more Physiologie in its full extent, is not onely capable of improving the Pharmaceutical part or Preparations for Remedies; (for, that we confessed already) but also of affording us a new & much better *Methodus medendi*, or skill of using the helps that Nature or Art hath provided against Diseases. And indeed the Physicians Art is so difficult, and a man must know so many things to be, though not tolerably, yet perfectly skill'd in it, that it may without disparagement to Physicians, be thought yet capable of being improved, if not of being reformed. *Hippocrates* begins his Aphorismes with a complaint, that Life is short, but Art long. And *Paracelsus* himself, though he say after his boasting manner, *Ars est longa, vita brevis, ubi autem donum finis* (as he speaks) *est, ibi ars est brevis, vita verum longa si arti conferatur*: Yet expounding the same words a litle above, he saith, *Itaq;* *Hippocrates merito de eo conqueritur: nam & a seculis ipseus iaem accidit: Ars medica consistit in Philosophia, Astronomia, Alchymia, & Physica, merito igitur dici potest Artem esse longam. Multum enim requiritur temporis, ad quatuor has Columnas Medicina discendas*

secundae & perscrutandas. Celsus, who hath been stiled Hip-
 pocrates Latinorum doth more then once call Physick a Con-
 jectural Art, as particularly in that place where he saith, *Lib. 3. c. 6;*
Est enim hac ars conjecturalis, neque respondet ei plerumque
non solum conjectura sed etiam experientia. And well might
 these great men acknowledg their Art to be difficult, since
 the two Instruments (as Galen calls them) of finding Arts, *In Prefatio*
 being Judgment and Experience, Hippocrates gives this *Lib. 1.*
 Character of them; *ἢ ὅτι ἐξ ὁρατῆς, ἢ ὅτι ἐκ τῆς χαλεπῆς.* And
 that Experience may be uncertain without the Theory of
 Physick, he that so much build's upon Experiments, Para-
 celsus, himself seems to confess, where expounding the
 words of Hippocrates, he saith, *Hoc modo se habuit Medicina*
in Principio; ut nullam Theoriam habuerit, sed solum Experi-
entiam hoc laxare, hoc constipare, quomodo autem & cur, id ig-
noratū fuit: ideo unus saluatus est, alter perditus, nunc autē, &c.
 And concenter the Critical part of Physick (to allude to
 Hippocrates his expression) Galen who exercised his reason
 so much about it, tells us that *Per rationem iudicium hand-*
quaquam facile existit, sed, si quid aliud, maximam habet dif-
ficultatem. And to affirm the difficulty of finding the best
 way of imploying reason to the cure of Diseases, not only
 by the Authority of Galen, but his Arguments; Let me in-
 form you, that after having told us how difficult a thing,
 and how rarely to be found is that reason, which considers,
 and determines what on every occasion is to be done, *Ne-*
que enim (addes he) si veritas esset inventu facilis, tot actanti
virii in ea quarenda occupati, in tam contrarias sectas fuissent
nuquam dispersiti. And Paracelsus, whatever he often else-
 where boastingly affirmeth of himself, yet handsomely e-
 nough both expresseth & confesseth the difficulty of being
 a good Physitian, in one of his Prefaces to the Students of
 B b Physick

In Commentar
Aphorif. 1.

Paracelsus in
his Preface to
his Bertheona,
or Chyrurgia
Minor.

Physick, whereas he sayes, *Non Titulus, non Eloquentia, non Linguarum peritia, nec multorum Librorum lectio* (*Ex hi hac non parum exornant*) *in Medico consideranda, sed summa rerum ac Mysteriorum cognitio, qua una facile aliorum omnium vices agit. Rhetoris quidem est discretè posse loqui ac persuadere, atque judicem in suam sententiam trahere. Medici autem effectuum genera, causas ac remedia novisse, & iis insuper sagacitate ac industriâ Pharmaca applicare, atque pro cuiuslibet ingenio ac ratione vel cunctis mederi:* But though, *Pyrophilus*, after the acknowledgments made by such great men of the almost insuperable difficulty of their Art, you would perhaps think it no great presumption, if a man should attempt to innovate in any part of it, and consequently even in the *Methodus medendi*: Yet *Pyrophilus*, I am much too young, too unlearned, and too unexperienced, to dare to be dogmaticall in a matter of so great moment. And the Physicians are a sort of men, to whose learned writings on almost all subjects the Commonwealth of Learning is so much beholden, that I would not willingly dissent from them, about those notions in their owne profession, wherein they seeme generally to agree; and do very much disapprove the indiscreet practice of our common Chymists and Helmontians, that bitterly and indiscriminately rail at the Methodists instead of candidly acquiescing in those manifest Truths, their Observations have enricht us with, and civilly, and modestly shewing them their Errors where they have been mistaken. And yet, *Pyrophilus*, Since divers of the eminentest Methodists themselves have more then once ingeniously acknowledged to mee, and seriously deplored with mee, in the compleatnesse of their Art, (which perhaps made (that Learned Prince) the late King tell them, that they were at best but good guessers) and since about divers particular diseases we have

have observed, the Method of some of the most reputed Doctors of *England* (which yet, I think, is at this day as well stored with Learned Men of that profession, as any part of *Europe*) not only differing, but repugnant to each other; I suppose we may without disrespect to their profession, dissent from the most of them about those cases, about which they are reduced to disagree so much among themselves. And it would be worth an impartiall disquisition, whether, since the *Methodus medendi* ought to be grounded on, and accommodated to, the Doctrine of Diseases, the new Anatomical discoveries formerly mention'd, and others not yet publish'd do not by innovating divers things in *Pathology*, require some alterations & amendments in the *Methodus medendi*? But in this particular, I dare yet affirme nothing, and therefore shall proceed to observe to you, that the usual efficacies of new remedies, may probably make the method of curing more compendious, because (as I lately also intimated) one Medicine may be so richly qualified, as to answer several intentions, which in the common way, require diversity of Helps and Remedies. Thus, for instance in the Cure of the Kings-Evil, by the received method, the Physitian must propose to himself several scopes (suited to several indications) & prosecute them successively with distinct & appropriated Remedies. But I have (as I formerly also told you to another purpose) known a single Specific Simple Namely (*Paronychia folio Rutaeco*) given only in small Beer, in not very many dayes, without any sensible Evacuation, waste the peccant humour, appease the pains (which before were very great) and discusse the unbroken Tumours, and heal the broken ones. Thus, according to the known Method, the great Remedy in Plurifies is copious Blood-letting, which is strictly prescribed even to aged persons and teeming Women, by the famous

Instances to prove that the unusual efficacies of new remedies may alter & make the method of curing more compendious: In the Kings Evil.

a *Plurifies*,

In the *Rickets*.

est of our practitioners, & I confess, not irrationally where the Physician is furnisht but with vulgar Remedies: and yet by some *Helmontian* Medicines, we have known *Plurifies* cured even in young men, without *Phlebotomy*, and our selves, some while since made a succesful trial of that Nature in a young Gentleman not unknown to you, which I mention not, with *Helmont*, to reject or so much as to disparage *Phlebotomy* in this disease (for so it be moderate & seasonable, Experience shews it frequently proves useful) nor as if we had observ'd all *Helmonts* boasted Remedies (though for the most part good ones) to be constantly succesfull; but to give you an instance of the truth, of what I was saying before, That new & more generous Remedies may so far alter the received *Methodus Medendi*, as to make divers of its prescriptions unnecessary. Of this truth, *Pyrophilus*, another instance might be afforded by the *Rickets*, a new & abstruse disease, at least as is supposed, & sometime so stubborn, that one of the famousst Physicians in *Europe*, (whom I think I need not name) hath not been able of late to cure it in several of his own Children. And yet I suppose you may have heard that Excellent Person your Mother, several times mention her having performed divers cures (some of them improbable enough) of this Disease, barely by that slight preparation of *Colchothar*, lately taught you, and presented Her by us; And by which (we having made & distributed, at Her desire, a considerable quantity of it) several other Persons have freed Children from that disfiguring Sicknefs: Of which, but few Months since, your little Cousin D. being almost past hope, was a while since brought out of danger, by Gods blessing upon some of the same Remedy, wherewith we presented her Mother, together with our perswasions to try it in her own Child, as she had

had successfully done on the children of divers others. And yet this Remedie (to adde that upon the By , in favour of something to be said anon) works almost insensibly , save that in many bodies it is, especially at first, Diaphoretique. And this property of that Remedie minds me to adde, that it would not be amiss for Physitians, to consider whether or no (however, Bleeding, Purging, Vomiting, Issues, Glisters, Scarifications, and those other painful wayes of Evacuation, be not however Chymists are too bitterly & undeservedly wont to reject them) to be altogether condemned and laid aside, yet there may not in some particular diseases & bodies be found more gentle, & yet effectual waies of discharging Nature of that which offends her, then those painfull and debilitating ones, which we have mention'd (without the use of one of the cheit of which, namely *Phlebotomy*, we see that almost all kind of diseases are cured in Children.) The contributing to render the waies of Cure less painfull & weakning, would gratifie so great a part of those who may need Physick, that I hope you will easily pardon my spending some pages to that purpose. I consider then, that oftentimes the peccant matter, though very offensive by its qualities, is much lesser then is supposed, in quantity, and might, if we were but Masters of Specifique Remedies, either be breathed out by insensible transpiration, or carried off by Sweat or Urine, without tormenting, or weakning the Patient, by those other copious Evacuations of grosser matter, which are alwaies troublesome & painful enough, though not alwaies essential. Nay that even in Chirurgery it self, if those that practise it were as knowing as Nature has been bountiful, there would not be so often a necessity as 'tis commonly supposed there is of mutilating or tormenting the Patient to recover him, You cannot doubt, unless

less You will deny what *Gulielmus Piso* affirms, upon his own observation, of the Cures done by the illiterate Indian *Empericks*. The passage You have seen already; But to it he adds so notable and ingenious an acknowledgment, that I cannot but honour him for it, and be willing to make way for the Credibility of a good part of what we are hereafter to deliver, in this discourse, by premising it, *Immo* (continues he) *ex venenatorum fungorum aliorumque toxicorum esu, solo potu infusi recentis radices Faborandi in instanti à letho vindicatos, me aliisque Galeni Nepotibus haud parum pudore suffusus, post tot alexipharmacorum & theriacalium Antidotarium irritos conatus. Ita ut postea ejusmodi collegas barbaros subinde mihi adjungi passus sim, non adeo quidem nostratum valetudinem ad tactum arteriarum moderari quam dictis modis consilii copiam præbere solitos.* Thus farre he: Which premis'd; let us proceed to consider, more particularly, some of the less painfull waies of freeing men from Diseases.

C A A P X.

That great Cures may by done by outward Applications.

Franciscus Bernius, Donzellinus, Ernestus Burgavius; who commend it upon their own experience, besides very many that commend it in general termes.

* De Lapid. & Gemm. lib. 2. cap. 11.

THAT great Cures may be done by bare outward Applications, You will scarce deny, if you dis-believe not the Relations which are made us, by Learned men, concerning the Efficacy of the *Lapis Nephriticus*, only, bound upon the Pulses of the Wrist's (chiefly that of the left Hand) against that stubborn and anomalous Disease the *Stone*: And that which gives the more credit to these Relations is, That not only the Judicious * *Anselmus Boetius de Boot* seems to prize it, but the Famous *Monardes* professeth himself not to write by Hear say of the great Vertues of this *Indian Stone*, but to have made tryal of it Himself upon persons of very high Quality:

Quality: And that which is related by * *Monardes* is much
 less strange, then those almost incredible things which are
 with many circumstances delivered of that Stone, by the
 Learned Chymist * *Untzerus*. And although it must be ac-
 knowledged, That some Stones, that go under the name,
 have been ineffectually applied in *Nephritick* Distempers,
 Yet the accurate *Johannes de Laet* Himselfe, furnisheth us
 with an Answer to that Objection, informing us that many
 of those *Nephritick* Stones (which differ much in Colour,
 though the best are wont to be greenish) although not at all
 Counterfeited, or Sophisticated, are of little or no Vertue.
 But that yet there are some others of them which can scarce
 be distinguished from the former, but by triall upon *Nephri-*
tick persons, which are of wonderful Efficacy, as he Him-
 self hath more then once tryed in his own Wife. *Garcias*
ab Orto (*Lib. 1. Cap. 53.*) mentions a Stone, found in *Bala-*
gar, call'd *Alaqueca*; of which he tells us, That though it be
 cheap, *Hujus tamen virtus* (to use his own words) *reli-*
quarum Gemmarum facultates exuperat, quippe qui sanguinem
undique fluentem illico sistat. *Monardes* (*cap. 35.*) re-
 lates the great Vertues of a Stone against *Hysterickall* Suffo-
 cations, and concludes, *Cum uteri Suffocationem imminen-*
tem presentunt, adhibito lapide subito levantur, & si cum
perpetuo gestant (Hysterici) nunquam simili morbo corrip-
untur, exempla hujusmodi faciunt ut his rebus fidem adhibe-
am. The same Author in the next Chapter, treating of
 the *Lapis Sanguinaris*, or Blood Stone, found in new *Spain*,
 (having told us, that the *Indians* do most confidently be-
 lieve, that if the flesh of any Bleeding part be touched with
 this Stone, the Bleeding will thereby be stanch'd) adds this
 memorable Observation of his own, *Vidimus nonnullos ha-*
emorrhoidum fluxu afflixos remedium sensisse, annulos ex hoc
lapide

* *Nicolaus Mo-*
nardes de sim-
pli. Ind. Hist; &
*seu tit. 20. * De*
Nephrit. lib. 1. c.
24. where he
hath nine or ten
observationes va-
ra & inaudite
de Lap. Nephri-
tico. Of the effi-
cacy of Lapis
Nephriticus and
other appensa.
De Gem & La-
pidibus, lib. 1,
c. 23.

Lapide confectos in digito continue gestandos, nec non & Menstruum fluxum sisti. And of the formerly mentioned *Lapide Porcinus*, the experienced *Bontius* (having mentioned how the *Indians* give the Wine wherein it hath been steeped, against the Disease called *Cholera*; which is as much, and as justly feared, by the Islanders of *Fava*, as the Plague is in *Holland*) adds this memorable passage, *Pregnantibus tamen hic Lapis non bene datur, nam abortu provocare adeo certum est, ut foemina Malaica mihi retulerint, ut si quando Menstrua eorum purgatio non bene procedat, si saltem hunc lapidem man gestent juvamentum se inde sentire.* And the relations, *Pyrophilus*, that I may in another place present You with, concerning the wonderful Stone, formerly mentioned, with which your Grandfather performed such eminent Cures, (particularly of the Stone, in the Lord of *Falkland*, then Deputy of *Ireland*, and others, to whose Backs it was applied) will, I suppose, make you the more readily give credit to the relations of the Authors we have newly mentioned. What *Monardes* mentions of the Vertue of the *Lapis Sanguinaris*, to Cure *Hamorrhoidal Fluxes*, puts me in mind of a yet much stranger thing, which *Helmont* affirms, namely, That he could make a mettall, of which, if a Ring were worn, the pain of the *Hamorrhoids* would be taken away, in the little time requisite to recite the Lords Prayer; and within twenty four hours the *Hamorrhoids* themselves, as well internal as external, how protuberant soever, would vanish, and the restagnant Blood would (as he speaks) be received again into favour, and be restored to a good condition. The same Ring he also commends in the suffocation & irregular motion of the Womb, & divers other Diseases: But if *Paracelsus* be in any case to be credited in an unlikely matter, We may think, by his very solemn Protestations, that

Helm. de Febr.
6.2.

that he speaks upon his own experience, That he had a Ring made of a Metalline substance, by him called *Electrum*, (which, by his description, seems to be a mixture of all the Metals joyn'd together under certain Constellations) which was of far greater virtue than this of *Helmont*; For, *hoc loco* (saies he) *non possum non indicare admirandas quasdam virtutes, q̃s electri nostri, quas fieri his nostris oculis videmus, adeoq̃ cum bona veritatis conscientia proferre attestari-que possumus. Vidimus enim hujus generis annulos, quos qui induit, hunc, nec spasmus convulsit, nec Paralysis corripuit, nec dolor ullus torset, similiter nec Apoplexia, nec Epilepsia invasit. Et si annulus hujusmodi Epileptici digito annulari, etiam in paroxysmo sevisimo, incertus fait, remittente illico paroxysmo, ager à lapsu illico resurrexit, &c.* But to take notice of some other outward Remedies. To our present Theme belongs that noble Cure, performed by the famous and experienced *Fabritius ab Aquapendente*; who tels us, That he cured a man of a *Scirrhus Lienis*, and a Dropsie, by the long use of Sponges, moistned with common Lime-water, and then expressed and worn upon the Spleen; notwithstanding the Muscles of the *Abdomen*, and all the other parts that lie betwixt the applied Sponge and the part affected. And to this we may adde, the strange Cures mentioned by *Kircherus*, and confirm'd to me by a Learned Eye-witnesse, to be frequently performed of very dangerous Diseases, in that Cave neer *Rome*, where the Patient being exposed stark naked, and tyed hand and foot upon beds of Straw; and being by the Sulphurous vapour of the place, and sometimes their own fear, cast into a swear, are lickt well by a great number of peculiar kind of Serpents that inhabit that *Grotta*. Moreover, we oftentimes see Agues cured by Amulets and Applications

Paracels. in Archidox Magic, lib.

De operat. Chirurg. p. 1. c. 15.

The Cures of the Dropsie and Scirrhus lienis by the external application of Sponges dipt in Lime-water.

Of strange cures performed neer Rome in the serpentine Grotta

to the Wrists, And I my self was, about two Years since, strangely cured of a violent *Quotidian*, which all the wonted Method of Physick had not so much abated, by applying to my Wrists a mixture of two handfuls of Bay salt, two handfuls of the freshest English Hops, and a quarter of a pound of blew Currans, very diligently beaten into a brittle Masse, without the addition of any thing moist, and so spread upon Linnen Cloath, & tyed about the Wrists. And with the same Remedies (which yet we have observed sometimes to fail) have divers others been cured, both of *Quotidian* and *Tertian* Agues: Nay an Eminent Physician gave me, lately, thanks for the great Effects he had found of it, even in continual Feavers.

Of the operations of Sulphur, Cantharides, Quicksilver, & Tobacco externally applied.

And here, *Pyrophilus*, I shall not scruple to acquaint You, with my having somerimes wished, that Physicians had been a little more curious to make Observations and Tryals of the distinct Operations of various Bodies outwardly applied. For I consider that, in some of them, the subtle Corpuscles, (which seem to insinuate themselves into the pores of the Body, and into the Mass of Blood, with little or no alteration) have much the like Operations with the Body whence they exhale, taken in at the mouth. As we see in some Preparations of *Sulphur*, which have like Vertues, inwardly given, and outwardly applied; and more manifestly in *Cantharides*, which I have found, by external application, to work strangely upon the Bladder, as that they excoriated it when taken into the body; & yet more manifestly in *Quicksilver*, which by inunction may be made as well to Salivate, as if it were swallowed down. And an eminent Physician lately complain'd to me, That washing a Childs scabby head with a Decoction of Tobacco, to kill and dry up the Scabs, the Boy was made thereby both sick

sick and drunk. And Learned men assure us, That by some *Catharticks* outwardly applied, those may be purg'd that will not swallow Physick. But other Medicines there are, which, before they get into the Mass of Blood, are much alter'd; either in straining through the flesh and Membranes of the Body, or in the Digestions they passe through in the Stomach, and elsewhere. And these may have very differing Effects, inwardly given, and outwardly applyed; as in the formerly mentioned instance of Hops, Currans, and Salt, neither any of the Ingredients inwardly given, nor the mixture hath been (that I know of) noted for any Febrifugal Virtues. So likewise Turpentine and Soot, that inwardly taken are good for quite other Diseases, (as Plurisies, and Obstructions of the Kidnies) outwardly applied are the main ingredients of *Pericarpiums*, extoll'd against Agues. And *Millefolium* or Yarrow, besides the Virtues it hath inwardly against Diseases of quite other Natures, being worn in a litle Bag upon the tip of the Stomach, was (as Himself confest to me) the Secret against Agues, of a great Lord, who was very curious of Receipts, and would sometimes purchase them at very high rates. And a very famous Physician of my acquaintance, did since inform me, that he had used it with strange successe. I know also a very happy Physician, who assures me, That he hath very often cured, both in himself and others, the Chilblains, when they come to be broken, by barely strowing on the sore parts the fine powder of Quinces thinly slic'd and dried. And who knows what unexpected Operations divers other Bodies may have, when outwardly applied, if various Trials of that Nature were skilfully made; especially, since we see that (for reasons elsewhere to be considered) some Bodies seem to have quite contrary Operations, when out-

Instances in divers Medicines, which have differing effects inwardly given, and outwardly applied.

wardly applied and inwardly taken. For we see that Spirit of Wine does, in several cases, allay the inflammation of the external parts, which given inwardly, would quickly inflame the body. And our often commended *Piso*, speaking of a choice Remedy for those distempers of the Eyes, that used to trouble men in *Brasil*, addes, *Idem quoque praestat manipahera, ex radice Mandihoca, qua licet pota venenosa habeatur* (as we formerly noted out of his and other Testimonies) *oculis tamen prodest, visumq. emendat*. And if the Simples, to be outwardly applied, beskilfully prepar'd, That may much vary & improve their operations. As we see that Vitriol, which is made of Copper, or Iron corroded by, and coagulated with Acid Salts, hath outwardly divers virtues which crude Copper has not, either outwardly or inwardly. And Gold dissolv'd in *Aqua Regis*, and precipitated with Oyl of *Tartar*, is inwardly, as far as I can discover, gently Purgative; yet the same *Aurum fulminans* being calcin'd with twice or thrice its weight of Flowers of Brimstone, till the *Flores* be burnt away, is known to be much commended by Chymists, and others, for a Diaphoretick. But though, as to any outward Virtues of the same Powder, Physicians and Chymists are wont to be silent, yet probably it may have very great ones, as well as quite differing from those it has, being taken at the mouth. For I know a person, that being grievously tormented with exulcerated *Hæmorrhoids* a very expert Chymist of my acquaintance, not knowing what else to do, applied to the part affected an Oyntment consisting onely of *Aurum fulminans*, prepar'd and fix'd by a slight and familiar way (which you may command) and made up with a little Oyl of sweet Almonds into a requisite consistence; and though presently upon the application of the Remedy, the pain for a quarter of an

Hour

That Preparation, may much improve Simples which are outwardly applied.

Instances in divers preparations of Gold.

An ointment made of Aurum Fulminans for the Hemorrhoids and Venereal ulcers.

Hour hugely increased, yet soon after it abated, and the Hemorrhoides the next day were closed, and the day after went away; Nor has the Patient ever since (that is, for some years) been troubled with any thing of Relapse. And the same Physician assures me, that with the like Remedy he has found a strange effect in Venereal Ulcers. And perhaps to this may be referred what has been found by some friends of mine, that phlegm of Vitriol, & *Saccharum Saturni*, which not onely inwardly given are said much to cool the Blood, but outwardly applied are good for Burns and hot Humours, do yet potently discusse cold Tumours. But least you should say, that this diversitie may proceed (at least in part) from the Corpuscles of differing Natures, that may be imagined in the forementioned Medicines; I shall return to what I was discoursing of before, and take notice of the Efficacy of some other external Remedies.

[Since the beginning of this ESSAY, I saw a lusty and very sprightly boy, Child to a famous Chymical writer, who, as his Father assur'd me and others, being by some Enemies of this Physicians, when he was yet an Infant, so bewitcht, that he constantly lay in a miserable torment, & still refusing the Breast, was reduc'd by pain & want of food to a desperate condition, the experienc'd Relater of the Story, remembring that *Helmont* attributed to the *Electrum Minerale immaturum Paracelsi* the Virtue of relieving those whose distempers come from Witchcraft, did according to *Helmonts* prescription, hang a piece of this Noble Mineral about the Infants Neck, so that it might touch the tip of the Stomach, whereupon presently the Child, that could not rest in, I know not how many Daies and Nights before, fell for a while a sleep, and waking well, cry'd for the Teat, which he greedily suckt, from thenceforth hastily recovering

The cure of a
Person esteem'd
Bewitcht, by an
appendix Minera-
ral.

wardly applied and inwardly taken. For we see that Spirit of Wine does, in several cases, allay the inflammation of the external parts, which given inwardly, would quickly inflame the body. And our often commended *Piso*, speaking of a choice Remedy for those distempers of the Eyes, that used to trouble men in *Brasil*, addes, *Idem quoque præstat manipahera, ex radice Mandihoca, quæ licet pota venenosa habeatur* (as we formerly noted out of his and other Testimonies) *oculis tamen predest, visumq, emendat*. And if the Simples, to be outwardly applied, beskilfully prepar'd, That may much vary & improve their operations. As we see that Vitriol, which is made of Copper, or Iron corroded by, and coagulated with Acid Salts, hath outwardly divers virtues which crude Copper has not, either outwardly or inwardly. And Gold dissolved in *Aqua Regis*, and precipitated with Oyl of *Tartar*, is inwardly, as far as I can discover, gently Purgative; yet the same *Aurum fulminans* being calcin'd with twice or thrice its weight of Flowers of Brimstone, till the *Flores* be burnt away, is known to be much commended by Chymists, and others, for a Diaphoretick. But though, as to any outward Virtues of the same Powder, Physicians and Chymists are wont to be silent, yet probably it may have very great ones, as well as quite differing from those it has, being taken at the mouth. For I know a person, that being grievously tormented with exulcerated *Hæmorrhoids* a very expert Chymist of my acquaintance, not knowing what else to do, applied to the part affected an Oyntment consisting onely of *Aurum fulminans*, prepar'd and fix'd by a slight and familiar way (which you may command) and made up with a little Oyl of sweet Almonds into a requisite consistence; and though presently upon the application of the Remedy, the pain for a quarter of an

Hour

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on, may much
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which are out-
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The cure of a Person esteemed Bewitcht, by an appended Mineral.

ring, to the great wonder, both of his Parents, and several others that were astonisht at so great and quick a change. And though I am not forward, to impute all those Diseases to Witchcraft, which even Learned men Father upon it; yet its considerable in our present case, that whatsoever were the cause of the Disease, the Distemper was very great and almost hopeles, and the cure suddenly perform'd by an outward application, and that of a Mineral; in which compacted sort of Bodies, the finer parts are thought to be more lockt up.]

The power of the
Jasper to stanch
Blood.

De Lapid. &
Gem. l. 2. cap.
102.

Among the proofs of the efficacy of apprehended Remedies, we must not pretermit the memorable Examples, that are deliver'd by the Judicious *Boetius de Boot*, concerning the Virtues of that sort of *Jasper*, which is Blood-red throughout the whole body of the Stone, not being mingled with any Colour: *Testari possū (saies he) me, qui alias lapidibus & gemmis tantas vires, quantas vulgus solet, non tribuo, credibile vix, de Jaspidis viribus, observasse. Nam cū ancilla fluxu menstruorū ita laborāset per aliquos dies, ut nullo modo sisti posset, Jaspidem rubrā impositā & rudem femori alligari jussī. Alius (in eadem domo) cum in pede vulneratus esset, nec sanguinis fluxus cohiberi posset, admoto lapide, exemplo impeditus fuit, licet vulnus non tegeretur.* To these he adjoynes a much more memorable Example, of a Maid he cur'd at *Prague*, who had been for six years sick of an Hemorrhagy so vehement, that there scarce ever past a week, in which she did not several times Bleed, neither could be she reliev'd by any Remedies, though she had long us'd them, till she was quite tired with them; wherefore our Author setting them aside, lent her a *Jasper*, of whole vertue in such cases he had made good trial, to hang about her Neck, which when she did, the Flux of blood presently ceas'd,

ceas'd, and she afterwards for curiosity sake, oftentimes laying aside the Stone, and as often as she needed it, applying it again, observ'd, that whereas the flux of Blood did not presently return upon the absence of the *Fasper*, but after divers Weeks, yet upon the hanging it on again it would presently be stop'd, so that she could not ascribe the relief to any thing but the Stone, by which our Author tells us, that at length she was quite cured. And speaking of the praises given by others to Green *Fasper* speckled with red, he concludes, *Sed ego, quod multisoties expertus sum, refero.* But amongst the Operations of outwardly appended Medicines, I have scarce met with a stranger than that which the Experienced *Henricus de Heer*, mentions in the fourteenth of those Observations which he truly styles *Rare*, namely, That a Woman, who had by an unskilful Mid-wife the Bladder lacerated, and thereby been subject to a perpetual *Incontinentia Urinae*, and had been reduced constantly to wear a Silver Pipe, was perfectly help'd, by wearing, as a Gipsie had taught her, a little Bag hung about her Neck, containing the powder made of a live Toad, burnt in a new Pot. Which relation I the rather mention, not only because the Author having try'd the Remedy upon a Merchant, to whom an unskilful Lythotomist had left the like Disease, found it presently to succeed, But because having been very desirous to have further trial made of so odd a Remedy, by a curious Physician, he lately gave me this Account of it, that though in one or two it had fail'd, yet having given some of the Powder to an exquisite Person, known to us both, he assur'd him it had succeeded in two or three. (And the Disease is too unfrequent, to give occasion to have the Remedy often tried.) And the Physician adds, that one of those Patients tells him (the Physician) that though her infirmity were occasion'd by a *Lacera-*

In Observ. Medic. oppido rariss. p. 194. The Incontinentia Urinae cured by the Powder of a Toad burnt alive, and hung about the neck.

Effects ascribed
to witchcraft,
cured per apen-
sa.

tio Vesicae, yet the Remedy helps her as long as she wears it about her, in case she renew the powder, when the virtue of it begins to decay: but that (which is remarkable to our present purpose) if she leaves it off a while, she finds the Disease return. The same *Henricus ab Heer*, among his freshly commended observations, has another of a little Lady, whom he concludes to have been cast into the strange and terrible Distemper, which he there particularly records by Witchcraft. Upon so severe an examination of the Symptoms made by himself, in his own house, that if, notwithstanding his solemn professions of veracity, he misrelate them not, I cannot but wonder he should confidently impute so prodigious a disease to some supernatural cause. But though the Observation, with its various circumstances, be very well worth your perusing; yet that, for which I here take notice of it, is, what he adds about the end of it, concerning his having cured her, after he had in despair of her Recovery sent her back to her Parents, by an outward Medicine, namely, an ointment, which he found extoll'd against pains produc'd by Witchcraft, in a Dutch book of *Carrichter's*: (where also I remember I met with it, set down a little differing from what he delivers.) Of which wonderful Ointment, the Ingredient that he found so extremely difficult to procure, namely, the Misseltoe of Hazel, being in *England* not so rare, but that I have more then once got it, and found, as he intimates, very green, and (what he mentions not) extremely bitter, I could wish, that those that have the opportunity would make tryal. For besides what *Carrichter* delivers, & our Author relates of it, a Learned Physician did highly commend it to the judicious *Gregorius Horsius*. And though if we allow it to cure bewitcht patients, the virtue that may be in external Remedies, will be made so much the more

con-

conspicuous; yet supposing the diseases to be, though strange, yet but naturall, we cannot but allow that there may be a wonderfull efficacie in an outward remedie, since it was able, only by anointing the Joints, and those pained parts with it, to cure a radicated Disease, attended with such wonderfull & horrid Symptoms. And after this it may seem but little, what else would appear a strange thing, which *Helmont* affirms of a Plaister he had, wherewith he tels us, That he safely cur'd hundreds of *Quartans*, even Autumnall, without relaps: elsewhere he saith, That he made his Plaister, for by the Circumstances I presume he means no other, of a few resolving and absterfive things; and adds, That it never fail'd him, but only that in fat Persons it succeeded more slowly. And yet in these, and the like ways of curing diseases, though approv'd if not also commended, by eminent Physitians both Ancient and Modern, there is no sensible evacuation made of peccant Humors, which perhaps materially remain in the Body, and may, by the *Effluvia* of these Remedies, be deprived of their former Qualities, & made so far obsequious to nature, that she is able, if need be, to ease her selfe of them by Sweat, Urine, or undiscerned transpiration.

And that the peccant humors remain for a while materially in the Body (the disease sometimes being removed) may appear by the Cures which we see now & then performed of Agues by suddain frights; by which no discernable evacuation is made of humors, though probably some considerable change be thereby produced in the temper of the mass of Blood, or in the Texture of the Morbifick Matter (as Physitians call it) As seems probable both from divers other things mention'd here and there in this Essay, & particularly from the lately recited Passage of *Helmont*, where

Helmont cured Quartans by a Plaister.

Helmont, de febr. cap. 14 vers. finem,

cap. 17. in fine.

*Diseases cured
by frights.*

Observ. Cent.

1. *Observ. 48.*

he takes notice of the rectifying of the peccant, and, by Nature, rejected Blood, without any sensible evacuation, upon the wearing of His Ring. I knew a Gentleman, a strong and resolute Man, who had been long a Souldier, and attained the highest sort of Military employments; notwithstanding which, he was strangely fearfull of Rats, and could not endure the sight of them: This Gentleman having been long troubled with an obstinate *Quartan*, & travelled with it into severall Countries, without being able to find any Cure for it, coming at length accidentally and suddenly into a place where a great Rat was in a corner, whence he could not flie from the Gentleman, he turiously leap'd upon him (yet without biting him) and thereby putting him into a fright, which freed him from the Ague that long had importuned him. And the experienced *Salmuth* tels us in a pleasant observation, of one who was cured even of the Gout by a fright. For this man having his Feet & Hands covered with a Poultis, made of Turnips, Flower and Milk, and being left in his Chair in a low Room, was, whil't his servants were all gone into the Garden, assaulted by a Sow, who finding the dore open, and invited by the smell of the Cataplasm, came to devour it; and striving to do so, flung the sick Man and the Chair to the Ground, and put him into such a fright, that our Author tels us, That very Day his Paines decreased, and continued lessening by degrees, till at length they wholly left him, without ever returning to trouble him again. There are divers Instances that discover what great changes may be produced in the Body, without taking in any thing visibly at the Mouth. And on the other side a good Air alone doth often, in Consumptions and other diseases, perform what hath in vain been expected from the use of emptying Physick. It wete to be wished that we had,

had, among our *European* Physicians, the *Physick* Bookes of those of *China*; for though our Doctors are much more Learned Men than theirs, yet probably their Writings and their Practise may teach us something that is new, & something making for our present purpose. For the famous Jesuite *Semedo* informs us, That the Books of our Physicians having not yet been brought to *China*, they are instructed in their Art by abundance of their own Writings, and that though in their practise they do not let Blood (as the learned *Varenius* tells us, That neither do the *Japonian* Doctors) or let Cupping-glasses, though they use no Syrrups, nor Potions, nor any Issues, but are Herbalists, using nothing but Herbs, Roots, Fruits, Seeds, &c. yet *Physick* (to use our Authors Words) is in a very good condition in *China*, (as *Almeida* also tells us, That the Physicians are much esteemed in *Japan*) And of the skill of some of the *Chineses* in that Art, he gives us in the same Chapter some considerable Instances. And though, as we said, it is very likely that their Doctors are much inferior, in point of Learning to ours, yet it is considerable, that in so vast, so civiliz'd, and so populous a Country, *Physick* can be practised with reputation, without the use of those Evacuations, which are here so frequently made in Phlebotomy, Potions and Issues. Nor should we only expect some improvement to the *Therapeutical* part of *Physick*, from the writings of so ingenious people as the *Chineses*; but probably the knowledge of Physicians might be not inconsiderably increased, if Men were a little more curious to take notice of the Observations & Experiments, suggested partly by the practise of Midwives, Barbers, old Women, Empericks, and the rest of that illiterate crue, that presume to meddle with *Physick* among our selves; & partly by the *Indians* & other barba-

Physick now in *China* is in a good condition without Phlebotomy potions or Issues History of *China*. part. 1. chap. 12.

[N. B.]

*Medicine facit
cunctis medicum
habent peritiam.
Agris salsa, ac-
crua, & plura
proponunt, dicen-
te Matseo pisces
& conchyliis
Pharmata sua-
via & odorata.
[N. B.] Sanguinem
nunquam es-
liciunt. Magnam
Medicorum di-
gnitatem videre
est ex Epistola
Almeide ubi
narrat, &c.
Bern. Varenius,
in Descript:
Regni Japonie
Cap. 25.*

where Practitioners of Physick are illiterate, the Specificks may be best met with.

rous Nations, without excepting the People of such part of Europe it self, where the generality of Men is so illiterate & poor, as to live without Physitians. For where Physick is practised by Persons that never studied the Art of it in Schools or Books, many things are wont to be rashly done, which though perhaps prejudicial, or even fatal to those on whom they are tryed, may afford very good Hints to a Learned and Judicious Observer: Besides, where the Practitioners of Physick are altogether illiterate, there oftentimes Specificks may be best met with. For such Persons, being wont, for want of skill in Physick, & particularly the Art of mixing Simples; and in that of varying their Remedies according to Circumstances, do almost wholly rely upon Specificks; whose Vertues, from their practise, may be sometimes better gathered, than from that of skilful Physitians, in regard that those empericks (besides, that they assist not with any skill in the *Methodus medendi* the vertues of their Remedies) are wont, for the Reasons newly mention'd, to try obstinately, and to the uttermost, the effects of their few specificks. And the nature of their Medicines may be the better known, in regard they are not wont to blend them, as Learned Men but too often do, with many other ingredients, whose mixture, as we formerly noted, either alters their nature, or makes it difficult to determine (as Galen himselfe in a like case confesseth, *Nā ut verū fateamur, hoc difficilis quoque res est & rara inventum, cum post multa remedia adhibita aegrotanti, quod ex his in causa fuisse dicitur ut melius pejusve habeat*) whether the effect be ascribed to what is given for the specifick, or to some other of the Ingredients, or to the whole Compound as such. The experienced Bonetus, in his excellent little Tract *De Medicina Indorum*, doth more than once confess, That it is very undeservedly that the

Galen in Aphor.
Apop. Comment.
x. The usefulness
of the Knowledge
of the Medicines
of Barbarous
Nations.

the Europeans look upon the East Indians as Barbarians. And even of those among them, that are ignorant of other things, he hath this Passage, *Hinc etiā fit, quod homines ceteris rithus idiota, tā exactā herbarum & stirpium nanciscantur scientiam, ut si vel Doctissimus Pavius, nostri avi Botanicorum princeps, ē mortuis resurgens huc veniret, miraretur se ab hisce hominibus barbaris doceri posse.* And Linchoten in his Voyages, speaking of that Famous Mart of the East Indies, the City of Goa, where the Vice-roy and the Arch-Bishop resided, & he himselfe lived: These heathenish Physitians (saith he, mentioning those of Goa) do not only cure their owne Nations and Country-men, but even the Portugals also; for even the Vice-roy himselfe, the Arch-Bishop, and all the monks & fryars, do put more trust in them than in their own Country-men, whereby they get great store of money, and are much honored & esteemed. I have not now the leisure to acquaint you with what I might alledge, to confirm this truth out of the practises of the illiterate Natives of some not yet sufficiently civiliz'd part of Ireland, and the Inhabitants of some other places where Physitians have not yet settled: But I shall mind you of the Confession of Celsus, where speaking of Physick, *Hæc nusquam* (saith he) *non est: siquidē etiā imperitissima gentes herbas aliq; prompta in auxilium vulnerum morborumq; noverunt.* And I wish that other Learned men would imitate the commendable example not only of Prosper Alpinus, who writ a Treatise *De Medicina Egyptiorum*; and of Jacobus Bontius, in his *Medicina Indorum*, but of Gulielmus Piso, who hath lately presented the World with the rude way of curing, used by the Brasilians themselves, in his new and curious Books *De Medicina Brasiliensi*, in the beginning of the second of which, he much confirms what we have been delivering, in the ensuing

Lib. 2. Dialog. 7.

Voyage chap. 34.

Preface lib. 1.

Piso de Medic;
 Brasl. Lib 2.
 Cap. i.

Georg; Ent. in
 Epistol. prefix.
 Exercit Har.
 vei de Gen.
 Animal.

ing Passage: *Quemadmodum multa in tam crassa Barbarie cruda vel corrupta arteq; Hypocrit. cā indigna reperiuntur, sic etiam non pauca utilissima antiquitatem redolentia: qua vel eruditissimos medicos ad urnas medicina subiciunt, observanda occurrunt. Quippe cum multarum Artium rudimenta vel ab ipsis Animantibus brutis (quibus benigna mater Natura arte insita inprimis curandis morbis destitui noluit) ad nos redundare fatendū sit, Quis dubitet ab his mortalibus, licet remotissimis à dogmaticā & rationali medendi arte, non plurima nobilissima at secreta remedia atq; antidota, medendi morbos veteribus incognitos quotidie ad posteros derivari? quibus paulatim ad manū traditi & tandem quasi in succum & sanguinē à rationalibus converfis doctorum schola & libri superbiunt? And to this agrees very well that grave saying of our experienced Harvey, to the very Learned Doctor Ent: Nulla gentam Barbara est quæ non aut fortuitò, aut inevitabili quadam necessitate coacta, aliquid in usum cōmunem adinvenerit quod Nationes alias humaniores latuit. Nor should we disdain the Remedies of such illiterate people, only because of their being unacquainted with our Theory of Physick. For though I will not say, as the old Empericks wittily enough did in that passage of Celsus, *Requirere etiam, ratio idem doceat quod experientia, an aliud? Si idem supervacuum esse, si aliud etiam contrarium.* But lest we should by too great reliance on the Galenical, or other ancient Opinions neglect usefull Remedies, because presented by Persons that ignore them, and perhaps too, hold Opinions contrary to them, I shal leave you to consider what is in the Person of the same empiricall sect, represented by Celsus, where having spoken of the darknesse of the causes of Things, & the uncertainty of the Theorems of physick: *Ac nihil istas cogitationes (saith he) ad Medicinam pertinere, eo quoq; disci, quod qui diversa**

de his senserint ad eandem tamen sanitatem homines perauxerint. Idem fecisse, quia non ab obscuris causis neq; a naturalibus actionibus, quæ apud eos diversa erant; sed ab Experimentis, prout cuiq; respondeant, medendi vias traxerint, ne inter initia quidem ab istis questionibus deductam esse medicinam sed ab Experimentis, &c. For though this sentence ascribes too little to reason, yet there is something in it that deserves to be considered: especially since we observe not that the late Anatomical Discoveries of the motions of the Chyle and Limphatick Liquor, by formerly unknown wayes, in newly detected Vessels, hath yet made Men cure Diseases much better than before. Not that I thinke that Anatomical and pathologicall Discoveries will not, in proceſſe of time (when the *Historia facti* shall be fully and indisputably made out, and the Theories thereby suggested, clearly established) highly conduce to the improvement of the Therapeutical part of physick; but yet this observation may make it the more reasonable to beware of relying so much upon the yet disputable opinions of physitians, as to despise all practises, though usually successfull, that agree not with them: For of such our Author speaks well, *In omnibus ejusmodi cogitationibus in utramq; partem diseri posse, itaq; ingenium & facundiam vincere: morbos autem non eloquentiam sed remediis curari; quæ si quis elinguis usu discreta bene norit, hunc aliquanto majorem medicum futurum quam sit, sine usu, linguam suam excoluerit.* And Paracelsus spoke well too, if he spoke truly, when in one of his prefaces, speaking to those whom he invited to hear him expound his Books of physick & Chyrurgery at Basil, *Illos tamen* (saith he of his formerly mentioned Books) *non aliorum more ex Hypocrate aut Galeno, aut quibuslibet emendicatus, sed quos summa rerum doctrina, experientia atq; labore assequutus sum, proinde si quid probatu-*

Celsi præfatio-
ne ad Lib. 1.

A Comparison
of the Em-
perick part of
Physick with
the Rational :

rus experimenta, ac ratio, auctorum loco mihi suffragantur.

It would, *Pyrophilus*, I fear, be tedious to trouble you here with all that I have met with in good Authors applicable to my present subject, and the design I have been prosecuting in favour of external remedies: But yet one Passage there is, which doth so notably confirme what we have deliver'd, as well touching the Efficacie of simple Medicines, as the great cures that may, in divers cases, be performed by outward Applications, that I must not here omit the mentioning of it, as I find the Epistle written out of *Perna* to the inquisitive *Monardes*, in these words: *In urbe Pesto, ubi aliquot annis vixi, omnis generis morbos Indus quidam curabat solo cujusdam Planta succo artubus & parti afflicta illito. Agros deinde stragulis egregie tegebat ad sudorem provocandum: Sudor è partibus illitis emanans, merus sanguis erat, quem inteis pannis abstergebat, atq; ita in curatione pergebat, donec satis sudasse putaret, optimis interea cibis eos alens. Eo Remeio multi morbi deplorati curabantur, imò agri juniores & robustiores ab ejus usu fieri videbantur. sed neq; pretio, neq; precibus, neq; minis unquam efficere potuimus, ut eam plantam nobis demonstraret.*

Petrus de Osma in Epist. ad Monard. que extat in libello de simplicibus medicamentis ex Occidentali India delatis.

C H A P. XI.

Of other extraordinary Medicines which work by Magnetisme, Transplantation, &c.

BUT, *Pyrophilus*, besides such external Medicines as work after the manner of those I have heretofore mention'd, we may possibly without absurdity, provided we do it without credulity, enquire, Whether there may yet be a sort of others that operate, in a more wonderfull & extraordinary way? And it would not perhaps be altogether unworthy the Experiment, to try whether or no, there may not sometimes be performed, such cures as are wont

to pass either for Fabulous or Magical; some of them being to be done without exhibiting, or applying any thing immediately to the Patient, & others by some such unknown wayes as those which Chymists call, either Magnetism, or Transplantation: such as are the cures reported to be perform'd by the weapon-salve, & Sympathetick powder, and such as is that cure of the Yellow Jaundice (mention'd with some verification by *Paracelsus*) wherein seven or nine cakes (for it must, forsooth, be an odd number) are made up with the newly emitted and warm Urine of the Patient, and the ashes of Ashwood, & buried for some days in a dunghil. For it is not onely by the easie and superstitious vulgar, that the possibility of performing such cures, by Transplantation, or some other Magnetical way (as they pleas'd to call it) hath been believed. For within the compasse of my own slender reading, I find that divers eminent Physicians, have both made use of, and commended Magnetical Remedies.

What is to be thought of the Sympathetick Powder; I confesse I am as yet in doubt, but however I shall take this occasion to inform You, That a very honest Gentleman, whom his Pen has made known to a great part of the Learned men, and Virtuosi in *Europe*, complaining often to me, that though he were much troubled with that sad disease, the Stone in the Bladder, yet he was more incessantly tormented with an Ulcer he had in the same part (all the searching Medicines that he took to dissolve, as he hoped, the Stone, exasperating the Ulcer:) I one day advis'd him to make trial of the Powder of Sympathy, upon some of the Ulcerous Matter he voided with his Urine; the Remedy being such, as if it had a Magnetick Virtue, might do him good, and if it had none, could not prejudice him; a while after, I receiv'd both from him in a Letter, and from his

E e

Physician

*The Cure of an
Ulcer in the
Bladder by Sym-
pathetick Pow-
der.*

Physician very great thanks for the advice; the Patient having since the use of the Powder, been eas'd of the distinct pain he was put to by the Ulcers, and this relief lasted, if I misremember not, above a Year, and how much longer I know not. But I shall not insist either upon this, or upon the Testimonies and Relations of *Paracelsus*, *Helmont*, *Coclenius*, *Burgravius*, nor even the modern Roman doctor *Servius*, nor any of the other Authors, that do professedly take upon them the defence of the Weapon-Salve, by reason of what we have elsewhere to write to you, by way of Examination of that Salve, and the Sympatherick powder, though I deny not in some trials, I have found them available; Yet besides what I have newly related, I have seen sometimes something follow upon the use of Sympathetick Powder, that did incline me to think, that sometimes it might work Cures. But I shall alledge something of more unexpected credit, & first *Dominicus Panarolo*, now professor of Physick at *Rome*, in his newly divulged *Fasciculus Arcanorum*, presents us two instances to our present purpose, in these words. *Mira (saies he) quotiaie reperiuntur in Medicina ad confirmationem operis quod Doctissimus Physicus, Petrus Servius (the same we lately mentioned) complevit de Unguento armario, sciendum est quod petia sanguine imbuta sub cineribus calidis posita menses sistit experimento pluries comprobata: quin etia magister meus Petrus Castellus (whose name his late Anatomie of the Civet Cat, and other writings have made famous) aiebat se expertum fuisse Hemorrhoides, si tangeretur tuberosa radice Chondrilla, siccari, si Chondrilla siccetur, corrumpi verò si corrumpatur: quapropter sub Camino excandanda ponitur, post hujusmodi tactum Chondrilla tuberosa.* The Learned *Salmuth* in his Observations furnishes us with an Example of a most violent pain of the Arm, removed by

Trans-

The effect of
Weapon-salve,
and other Mag-
netical Reme-
dies.

Tab. 3. Fasc.
Arcan. 1.

Centur. 3. Obs.
21. 3.

Transplantation: they did beat up Red Corals with Oaken leaves, & having kept them on the part affected, till suppuration; they did in the Morning put this Mixture into an Hole bored with an Augur in the Root of an Oak, respecting the East, and stopt up this Hole with a Peg, made of the same Tree, from thenceforth the pain did altogether cease; & when they took out the Amulet, immediately the torments returned sharper than before. A great and excellent Lady (a near Kinsman, *Pyrophilus*, of yours & mine) & very far from credulous, confest to me, as did her servants also, that with the above mentioned Remedie of Ashes and Urine, she was not only once cured of the Yellow Jaundice, by a friend of hers that had observed, that she had been fruitlessly vexed by a Tedious course of Physick, prescribed by the famousst Doctor then in *England*, but that afterwards relapsing into that same disease, she had cur'd her self by the same remedy. I remember, that being some years since brought almost to the brink of the Grave by a sudden effusion of Blood within my Body, from which, without a signal mercy of God, I should not have recovered; among other men skilld in Physick that came to assist me in that danger, I was visited by a Galenist of much repute, whose pale looks inviting me to enquire what it was that ailed him, he answered me, That he had not long before been desperately sick of an obstinate *Marasmus*, which notwithstanding all the Remedies he could use, did daily so consume him, that he appeared but a Skeleton, whereupon having found the uneffectualness of ordinary Remedies, and being hopeless of being relieved by them, he resolved to try a Sympathetick Medicine, which I remember my self to have met with in *Hartman*. He took then an Egge, and having boiled it hard in his own warm Urine, he with a Bod-

kin perforated the shell in many places, and then buried it in an Ant-hill, where it was left to be devoured by the *Emmets*, and as they wasted the Egge, he found his distemper to lessen, and his strength to increase, insomuch that he now conceived his disease to have quite left him.

Observations of
the Translanti-
on of Diseases.
River. Cent. 4.
Observ. 63.

The Experienc'd *Riverius* in his last Observations (newly published since his death) has two notable Examples to our present purpose. For first he tels us, that the eldest Daughter of a great Officer in *France*, was so tormented with a *Paronychia* for four daies together, that the pain made he pass the night sleepleffe; whereupon having by *Riverius* his order, put her finger into a Cats Eare, within two hours she was delivered from her pain, and her whole hand, which before was tumid, unswell'd again; except the finger, which it self was out of pain. The other case was of a Counsellors Wife, who by the same Remedy was cured of a *Panaritium* (which had for four daies vexed her) in a much shorter time than the other, namely within a quarter of an Hour. But that which chiefly makes these stories pertinent to our present occasion, is this notable Circumstance, that in both the cases, the Cat was so manifestly put to pain, that *Riverius* thought it had attracted to it self the morbid matter from which it freed the Patient. For in the former of these two cases, the Cat loudly complain'd of the pain he felt, and the other was, in that short time the cure was performing, put to so much pain in his Eare, that two men were hardly able to hold him fast, he struggled so forcibly. And these two relations of *Riverius*, may, though there be some disparity in the cases, give some countenance to what might otherwise be distrusted in the Observations of the industrious *Petrus Borellus*, where he saies, *Podagra mirè levatur, si catelli cum podagrico recumbant, morbum enim contrahunt*

River. Cent. 4.
Observ. 19.

In Historiar. &
Observ. 3. Medi-
cophysic. Cent. 3.
Observ. 28.

adco

and ut vix incedere queant; Ager vero levamen suscipit.
Which perhaps he may have been induced to write, by the story that goes of, that odd Chymist, *Robert Fludd's* having transplanted the Gout of one of his Patients, by making him often sleep with a Dog that was fond of him, who thereby became afterwards subject to such periodical fits of the Gout, as the Master, had been troubled with.

[And since I begun this Chapter, and met with these Objections, discoursing of this matter with a judicious person, well skill'd in Physick, and whom his learned Writings have made Eminent, He told me, that he had not very many Months since, seen a Cure by Transplantation, perform'd on the Son of one that was wont to make Chymical Vessels for me: and because the Observation is considerable, that there might be no mistake in it, he has pleased to set it me down in writing (attested with his annexed name) which inables me to present it you in his own words. *N. N.* of *N. Potter*, had a Son, who was long sick of the Kings Evil, which swell'd much, and broke into Sores at last, which he could by no ordinary means heal. The old man had then a Dog, which took an use of licking the sores, which the Dog continued so long, till he wasted the very kernels of Ulcers that were knit in with the veins, and perfectly cur'd the Sore, but had the swelling transplanted to himself, so that he had thereupon a great swelling, that arose and continued on his Throat. The Lad was thereby freed, so continued to be till 1660, & for ought I know is so this day. This I saw, being there at that time to view the Clays, and bespeak Retorts of the old man.*]

* Some years since the present Essay was written, I lighted on the 66. *Observ.* of the industrious Bartholinus, 3 Cent. and the 53 *Observ.* of his 6 Cent. in both which places giving instances of the Transplantation of Diseases he mentions, besides some of those Examples delivered by us, divers others; for which I am willing to refer you to the alledged places, only in the last of these Observations delivering something as upon his own knowledge (which he does not in the rest of the instances) that much confirms what we have mentioned concerning Fludd. We shall annex it in his own words. In *Catello Milefio* *Avi nostri materni, quem jam alit in ædibus suis Avunculus meus suspicien-*

mus M. Jacobus Finckius Phys. P. P. & Academiæ nostræ senior, evidentiùs hunc patuit trahendi facultas. Colico dolore torquebatur Avunculus, Canis ventri impositus, quum incaluisse, urgebatur, vomuit vehementer, & tormina colica Avunculi remiserunt. Ancilla ejusdem in dolore dentium eundem canem genis apposuit, sensitque levamen, sed canis dolorum impatientia hinc inde circare & larrare. Idem expertus est scriba in Colli Tumore.

And

century. X. Exp.
997.

And to confirme the credibility, as well as increase the number of our Magnetical waies of cure, I shall adde, that *S^r Francis Bacon* himself records, with great solemnity, his own having been freed, not onely from very many new warts, but from one almost as old as he, by a piece of Lard with the skin on it, which after having rubb upon them, was exposed out of a Southern Window to putrefie. And therefore though the vanity and superstition of the Authors that speak of Magnetick Remedies, & the impertinent circumstances that are usually prescribed, as necessary to their effectualness, do generally & justly enough, make sober men despise, or at least suspect such unlikely waies of cure; yet in consideration of instances lately produced (to which we may perhaps elswhere adde some others) and because divers men, as well Physicians as others, have seriously assured me of their having been some of them eye-witneses, and others performers of such cures; I am apt to think it fit, that a severe indeed, but yet further trial be made of Physical Experiments of this kind. And I cannot but commend the curiosity of *Dr. Harvey*, who, as rigid a Naturalist as he is, scrupled not often to try the Experiment mentioned by *Helmont*, of curing some Tumors or Excrefcencies, by holding on them for a pretty while (that the cold might thoroughly penetrate) the hand of a man dead of a lingering disease; which Experiment the Doctor was not since pleased to tell me, he had sometimes tryed fruitlessly, but often with good successe. Nor doth the grand Objection against such Experiments, namely, that such or such a person, having once made trial of them, found them not succeed, seem at all to me, alone, of weight enough to make such Experiments, or those other improbable ones formerly mentioned, totally rejected. Because, if they really
do

do sometimes succeed, though sometimes they chance to fail, yet that possibility of their succeeding may sufficiently evince, that there are really in Nature Medicines that work after that extraordinary manner. And I see no reason, why it should be more required of those Medicines, that work at distance from the Patient (or at least are not taken at Mouth, or injected elsewhere) only by subtle *Effluvia*, that they should alwaies cure, then it is exacted of vulgar Remedies, from which we might reasonably expect more constant effects, because of their being either inwardly given, or more immediately, or at least, more durably applied to the Patient. And if Rubarb be justly affirmed to be an excellent medicine in Loosnesses, though we daily in *Ireland* see many swept away of those diseases, in spite of the use of Rubarb and Mirabolans, with other astringent Remedies to boot: And if Quick-silver be, not unreasonably, by most of our Physicians, esteem'd and employed as an effectual Remedy against Venereal Diseases, because it sometimes removes them, though *Fernelius*, *Montanus*, and many other Learned Authors tell us, as they say upon their own experience, that (though it often palliate those distempers) it very seldom cures them: Nay, and if Diaphoreticks are still esteemed such by the generality of Physicians, though few Sudorificks will cause sweat in all bodies, and scarce any in some bodies, I see not, why these Remedies, that work, as it were, by Emanation, may not deserve the name of Medicines, if they sometimes unquestionably succeed, though they should not alwaies prove succesful ones; Nor why they should, notwithstanding their sometimes not succeeding, be laid aside, especially since these sympathetical wayes of cure are most of them so safe and innocent, that though, if they be real, they may do much good, if they

prove

*The sometimes
not succeeding of
Magnetical me-
dicines no suffi-
cient cause to ab-
bandon their use.*

prove fictions they can do no harm, (unlesse by accident, as in case the Patient should so singly rely on them, as to neglect (which he need not all) other helps to recover.)

C H A P. XII.

BUt you will now perhaps demand, *Pyrophilus*, how the Naturalist, as such, can contribute to the Credit or Advancement of the mentioned wayes of curing Diseases, without the wonted weakning and painful Evacuations? In answer to this Question, I must put you in mind, That it would be no new thing for Naturalists, not professedly Physicians, to treat of this subject; and that the Naturalist may afford good Hints to the Practitioner of Physick, both upon divers other accounts already toucht upon, and by trying upon Bruits variety of hitherto untryed Medicaments or Remedies, and by suggesting to him both the Events of such Tryals, and also what hath been already observed about the cures of Diseases incident to Beasts. For though (as we formerly told you) there are some things that are not equally Poysonous, as others not equally Safe, to Man, and to *some* Bruits; yet there are other Beasts, especially Dogs, and Monkeys, whose Bodies are, by many Poysons, affected almost like those of Men. And since according to the Rule, *Periculum faciendum est in vili animali*, many things may be very well tried on such Creatures, that we dare not at first venture to try on Men. We may give Dogs Poysons, onely to try the virtue of our Antidotes; and we may give them Wounds, to make trial of the efficacy of the Weapon-salve and Sympathetick Powder: Since divers of my Friends (as I have intimated above) assure me, That they have some of them seen, and others performed cures of Horses, lam'd by pricking,
by

*Instances of
divers Cures up
on Bruits, and
how these are
applyable to men.*

by sticking the Nails that hurt them into Weapon-Salves; which for that very use, among others, some of them are wont to carry about them in Silver-Boxes. When Oxen and such like Cattle, are troubled with that Disease which makes them continually turn about in one place (and is therefore called the *Turning-Evil*, or *Sturdy*) a common Remedy here in *England*, as Graziers that make use of it inform me, is to cast down and tye fast the sick Beast, and then to open his Skull a good way (or, if need be, take off a round piece of it over the place supposed to be affected) and at the open place to take out a little Bag or Bladder, which is usually found to lye near the Membranes of the Brain, and to be full of Water and Blood, and then leisurely to heal up the hurt. And this cure is much commended, as both common and easie(by our experienced *Markham*. In Goates likewise, that are much subject to the Dropsie, the Husband-man ventures to slit, and let out the Water under the Shoulder. And divers hazardous Operations in Chirurgery, such as are Arteriotomy, the Exection of the Spleen, and other parts, were, or should have been first attempted upon Bruits, and then practised on humane Bodies: And in imitation of these, tis likely that divers other Experiments, of good use in Chirurgery, may be discovered for the relief of Man, without endangering him in prosecuting such Discoveries. And to say nothing of the known practice of spaying Swine, & Bitches, in the neighbourhood of a Countrey house of mine, in the West of *England*, & probably in divers other parts, some experienced Shepherds have an odd way of castrating male Sheep, especially Lambs when they are grown so old, that tis thought dangerous to geld them the common way. A Servant of mine that deals much in Cattle, and had lately divers Sheep swigg'd (as they call it) after this manner, tells me that its thus done: the Beast, on whom the Operation is to be performed, being

held by a strong Man with his Belly upwards , another Man draws a String, as firmly as he can (tying it with a Knot or two, to prevent its yielding or slipping off) about the Testicles, as if he meant, by drawing that string, to cut them off; and then anointing the part with a little fresh Butter, or some such like thing, he lets the Ram go to feed; which for the most part (notwithstanding the anguish of this Ligature) he will begin to do in a short time: And within two or three daies, the Testicles, being by the strict Ligature, denied the Nutriment and Spirits that were wont to be conveyed to them, will grow so rotten, as either, together with the string, to fall off, or be very easily pull'd off, sometimes stinking very rankly like Carrion. And even among those things that are already practised by Farriers, Shepherds, and Graziers, there are many such things as we have newly mentioned, which may serve either to enrich or illustrate the way of curing humane Bodies: Their ignorance and credulousness, together with the liberty and meanness of those Creatures they physick, gives them leave to venture on any thing, having made them try upon Horses, and Cattle, many such things as Physicians dare not try upon Men and Women. And among those many extravagant things, some, as it often happens, have succeeded so prosperously, as to deserve to be considered by the skilfullest Physicians; Some of whom might, without disparagement to their profession, do it an useful piece of service, if they would be pleased to collect and digest all the approved Experiments and practices of the Farriers, Graziers, Butchers, and the like, which the Ancients did not despise, but honoured with the Titles of *Hippiatrica*, and *Veterinaria*: And among which, if I had leisure, divers things may be taken notice of, which might serve to illustrate the *Methodus medendi*. As to give you but one instance which lately occurred to me, the Usefulness

fulness of letting blood in some cases, which is so severely condemned by many Chymists, and the efficacy of a small, if seasonable, Evacuation, which can scarce be conceiv'd to do more than alter the course of the Blood, may be illustrated by the Staggers in Horses, and the Cure of it. For I have seen a Coach-horse, ready to drop down dead of his Disease upon the High-way, by having his Gums rub'd with the Coach-whip till the Blood appear'd, relieved almost in a moment so much, that though he were not well able to stand before, yet he was immediately able to go on, and draw the Coach with his fellows.

C H A P. XIII.

THE next thing we are to observe to you, *Pyrophilus*, and on which its nature and importance will engage us somewhat long to insist, is this; That the handling of Physical matters was Anciently thought to belong to the Naturalist; as we are clearly informed by the judicious *Celsus*, in that memorable passage, where he speaking of the *Origin of Physick*, *Primo* (saies he) *medendi scientia Sapientia pars habebatur; ut morborum curatio & rerum natura contemplatio sub iisdem Authoribus nata sit: Scilicet his hanc maxime requirerentibus, qui corpora suorum robora, inquieta cogitatione nocturna, vigiliâ, minuerant.* He adds, that many of the Professors of Philosophy, especially *Pythagoras*, *Empedocles*, and *Democritus*, and that *Hippocrates* (whom some think to be the Disciple of the last named) was the first that sever'd Physick from Philosophy, and made it a distinct discipline. And this Apology for the ensuing discourse being thus premised to it, I shall further Answer, that I should perhaps be obliged to exceed the limits of an ESSAY, if I should in this Discourse insist on every thing, upon whose account the Naturalist may assist the

That the handling of Physical matters was anciently thought to belong to the Naturalist. Celsus in Pref. l. 1.

Physician, if he be barely a *Medicus* to cure Diseases, which that you may the more readily believe, I shall select and prosecute some of these things in the remaining part of this ESSAY.

That the rejecting Specificks because they make no visible Evacuation, is irrational.

And first I shall represent to you on this subject, That the account upon which Physicians are wont to reject, if not deride, the use of such Specificks, as seem to work after a secret and unknown manner, and not by visibly Evacuating peccant humours (or by other supposedly manifest Qualities) being generally this. That they see not how the promised Effects can well be produced by Bodies, that must work after so peculiar and undiscerned a manner; This being, I say, the great thing that hinders Physicians from endeavouring to find, or, so much as being willing to make use of Remedies of this sort, the Naturalists may do much towards the removal of this Impediment, by shewing out of such things as may be met with or performed within the Macrocosme, That such, or at least as strange Operations as are ascribed to these Specificks, are not without Example in Nature; and consequently ought not to be rejected, barely as being impossible. And indeed the Physiologie, wherewith Physicians as well as others are wont to be imbu'd in the Schools, has done many of them no small Disservice, by accustoming them to grosse apprehensions of Natures ways of working. Whence it comes to passe, that not a few even Learned Doctors will never expect, that any great matter should be performed in Diseases, by such Remedies as are neither obvious to the Sense, nor Evacuate any grosse, or at least sensible matter. Whereas, very great alterations may be wrought in a Body, especially if Liquid, as is the Blood and peccant Humour, without the Ingresse or Egresse of any visible matter, by the intestine commo-

tion

tion of the parts of the same body acting upon another; and thereby acquiring a differing Motion, Location, (if I may so speak) or Figure, which, with the other Qualities and Effects resulting thence, may alter the motion and Texture of the Liquor, and thereby produce great changes in the Body that harbours it. How much an unperceiv'd recess of a few subtle Parts of a Liquor may alter the Nature of it, may be guess'd at, by the obvious change of Wine into Vinegar; wherein upon the Avolation (or perhaps but the misplacing) of so little of the Spirituous and Sulphureous part, that its Presence, Absence, or new Combination with the other parts is not discernable to the Eye, the scarce decreased Liquor, becomes of a quite differing Nature from what it was. And though in *England* this Degeneration be not wont to be so suddenly perform'd, by reason of the coldness of the Climate, yet in hotter Countries the Change is much more speedily made. As in *Brasil*, the above mentioned *Piso* informes us, that the expressed Juice of the Sugar-Canes, which by Coction, and farther ordering, would be certainly brought to Sugar, will of it self keep sweet but about four and twenty Houres, and then begin to sower, and be altogether unfit to make Sugar of, though very fit to turn into good Vineger. And this I find confirm'd by a Modern and applauded *French* Writer, in his Description of some parts of the West *Indies*, inhabited by his Nation: And relations of the same sort, concerning the hasty sowing of some other Liquors in *America*, I have had from our *English* Travellers and Planters. And in the East-*Indies*, *Linschoten* tels us of a change much more suddain: For speaking of the formerly mentioned *Sura* or Liquor, afforded by the wounded *Coco* Tree. The same Water (saies he) standing but one Hour in the

Sun

That great changes may be made only misplacing without any Evacuation of the parts.

Lib. 4. cap. 10.

The making of Vineger is an Instance of this truth, especially in the Indies.

Chap. 36.

See Pifo l. 1.

In the effects of
Thunder and
Earthquakes.

Sunne is very good Vineger, and in *India* they have none other. And that even very hurtful Liquors (and why not then some peccant matter in the body?) may after the like manner change their Nature, may appear by what we have formerly mentioned, and is unanimously affirm'd by credible Writers of several Nations, concerning the juice of *Mandioca*, which, being poyson, when it is first express'd, does in a few hours by Fermentation, purge it self and loose its pernicious Nature. That also by the bare Ingresse of some subtle and not visible Matter, such intestine commotions may be excited in Liquors, may appear by the sowing which has been often observed upon great Thunders to happen, not onely to Wines, but to other Vinous Liquors also, as I lately received from a great Master of variety of Liquors, a complaint that by some Thunder, which happen'd here a few weeks since, almost all the Beer and Ale in the Neighbourhood was spoyl'd. And I remember, that when I return'd out of *Italy* through *Genova*, there hapned in that place an Earthquake, upon which, the Citizens complain'd, that much of their Wine was sowred, though I that lodg'd in the highest part of the Town, saw nothing to make me believe, that the bare Succussion of the Earth was capable to produce so great and suddain an alteration in the Wine.

Divers Instances to prove, that invisible Corpuscles may passe from Amulets, and cause great alterations in the Juices of a mans Body.

That such invisible Corpuscles may passe from Amulets, or other external Remedies into the Blood and Humors, and there produce great changes, will scarce seem improbable to him that considers how perspirable according to *Hippocrates* a living body is, and that a Vegetable and Animal Bodies, whose Texture is more loose and open, may well be supposed to send forth Expirations, since even divers Minerals are found to do the like, as may appear by the odorable steams of rub'd Brimstone, and Amber, by the Corpuscles, which perform the Magnetick Operations

tions, by the Emetick Quality imparted to Liquors by the Glasse of Antimony, and by *Crocus Metallorum* barely infused in them, without sensibly loosing any thing, either of their bulk or weight; and by the virtue of killing Worms, witherewith Wine, and even Water has been, not onely by *Helmont*, but by divers other Physicians, observed to be enricht, after a Quantity of *Quick-silver* has been for some Hours shaken in it, though without any sensible deperdition of the substance of the *Mercury*. And indeed I have somewhat wondred that many Learned Modern Physitians, either out of an affected Severity, or perhaps Animosity against Chymists overlook or even deride all operations of this Nature; Since I remember *Galen* himself, not only confirms the like doctrine, by his reasons and Authority, but delivers a very strange Example of it; for, under the Title of *Glychysida*, treating of *Peony*, he thus Discourses: *Est præterea omnino rescicatoria; Ea propter haud desperavimus eam ex collo pueris suspensam merito Comitalem morbum sanare. Equidem vidi puellum quandoq; octoties mensibus morbo Comitiali liberum, ac postea fortuna cum quod à collo suspensum erat decidisset, protinus denuo convulsione correptum; rursusq; suspenso in locum illius alio, inculpatè postea egisse. Porro visum est mihi satius esse rursus id collo detrabere, certioris experientia gratiâ: id cum fecissem, ac puer iterum esset convulsus, magnam recentis radice partem ex collo ejus suspendimus, ac deinceps prorsum sanus effectus est puer, nec postea convulsus est. Rationabile itaq; erat, aut partes quaspiam à radice defluentes, ac deinde per inspirationem attractas, affectos ita locos curare, aut Aerem à radice assidue mutari & alterari. Nam hoc pacto Succus Cyrenæicus collumellam phlegmone affectum juvat, & Melanthion frictum palam Catarrhos & Coryzas desiccant. Si quis id in calidum linteum, rarum, liget assidueq; calorem ex eo per inspirationem in nares attrahat. Quin etiam si pluribus*

*De simp. Medi
facultatibus, l. 6.*

*Galen's Exam
ple of Peony;
root, &c.*

linis

linis, & maxime marina purpura, collo viperæ injectū, illi viperam præfoces, eaq; postea cuiuspiam collo obvincias, mirifice profueris tum Paristhmis tum omnibus iis quæ in collo expullulant. Nay, that such invisible Bodies, by passing through grosser ones, and thereby changing the Motion and *nexus* or Juncture of their parts, may produce lasting alterations in the Textures (though it be a Paradox) seems not at all to me impossible. For we find the most fluid Body of Quicksilver *has been* sometimes, (I say sometimes) and therefore *may*, without sensible increase of *Bulk*, be coagulated by a Metalline Exhalation so, as to be cut like Lead, and to retain that Solidity, till by some Art or other it be reduc'd to its pristine Fluidness. You may be inclin'd to think, that the hard and solid body of Iron has a permanent alteration made in its Texture, if you hold a Needle during a competent time near the Pole of a Vigorous Loadstone without touching it. For the Magnetical *Effluvia* (as may very probably be conceiv'd) will so dispose the parts of the nearest Extream of the Needle, as that they shall admit the Steams that come from one of the Poles of the Load-stone, and not those that come from the other: whereas by skilfully holding it to the contrary Pole of the same Stone, the internal Pores, and consequently the Texture of the Needle, will presently be quite otherwise disposed, in reference to the Magnetical *Effluvia*; as we more fully declare in another ESSAY, where we shall, I suppose, also perswade You, that the Effects of the Loadstone are performed by subtle Bodies issuing from, or passing through it. What we have in the former Discourse told you concerning our having at pleasure changed the Poles of a Load-stone, by help of the Magnetical *Effluvia* of the Earth, may let You see, that in Stones also such alterations are possible to be made. And in the next ESSAY

save one, we shall give you another Instance pertinent to our purpose. For if you heat a slender piece of Steel (as a Graver, or the like) red hot, and suffer it to cool leisurely in the Air, it will continue flexible enough, and of so soft a Texture, that you may easily make impressions on it with any hardened Steel: but if, in stead of cooling it thus slowly, you knock it into such a dry body, as we shall there name to you, it will immediately grow so hard, as to be brittle. Which alteration, whether it be resolved to proceed from the particular *Effluvia* of the Body, into which it is knocked, or barely from the ingresse of the corpuscles of Cold, (if any such there be) it will be however an instance not unfit for our purpose. And those, *Pyrophilus*, that are conversant in Glass-houses, may easily observe, that Glass acquires a more or less brittle texture, according as (to speak in the Glass-mens language) it is baked. For if, after glasses are blown, they be quickly carried into the open air, they wont to be much more subject to break, than those, that after they are fashioned, are plac'd in a kind of very long Oven (which is wont to be built over the furnace, wherein the materials, whereof the glass is made, are kept in fusion) & are by slow degrees refrigerated, and not till after some hours exposed to the open Air: For whether this difference of brittleness, & consequently of texture, be ascribed to the interrupted transcurfion of some Etherial matter, through the pores of the Glass, or to the insinuations of the Atoms of the Cold; or to this, that the particles of the Glass agitated by the heat, were surpriz'd by the cold before they could make an end of those motions which were requisite to their disposing themselves into the most durable texture; it is evident enough, that tis by no gross or visible Body, that this permanent difference of texture is produced. Of the like to which we may elsewhere give you Examples in some other Concretes. That also in an human body, great alterations may be made by very subtil *Effluvia*

*Of purging by the
Order of Potions.*

G g

appears

Cent. 3. Obser. 4.

Cent. 3. Obser. 8.

Lib. 3. cap. 9.

Of the purging
and vomiting
Quality of the
Air of the moun-
tain Pariacaca.

243. 244.

appeares evidently, not onely by the instances we have formerly given of the efficacy of some outwardly applied Remedies, but by divers other things; as that many are purged by the bare Odor of Potions, of which I have been assured upon his own Observation by the experienced Town Physician of *Plimmouth* Dr *D.* And of which *Salmuth* in his Observations, gives us an instance in a young Gentlewoman, whom he saw more happily purged by the Odor of a Potion, drunk by her Sister, than she was that took the Medicine. And the same Author tels us, of one Dr. *Pfeil* an eminent Physician, who was wont, when he had a mind to be purged, to go into some Apothecaries shop, where Electuaries electively purging were preparing, to which having a while smelt, they would by their Odor, after his return home, work with him six or seven times, as if he had swallowed the Medicine it self. And *Henricus ab Heer*, in the twenty ninth of his formerly commended Observations, tels us of a Woman, that not only was wont to be copiously purg'd by drinking Bief-broth, but having by a fall broken her Leg, us'd no other Cathartick, than the bare Odor of that sort of Broth. And very observable to our purpose is the operation of the Air, all along the ridg of the high mountain of *Peru*, called *Pariacaca*, of which the learned Jesuite *Joseph Acofta* relates, That though he went as well prepared as he could, to withstand the Operations usually produc'd in Travails, by that piercing Air, yet when he approached to the top of the Mountain, he was (notwithstanding all his provision) surpriz'd with such fits, and pangs of striving and casting, as he thought he should cast up his Heart too; having, after meat Phlegm, and Choler, both yellow and green, in the end with overstriving cast up blood; & continued thus sick for three or four hours, till he had passed into a more temperate Air than that of the top of the Mountain; which runs about 500 Leagues, and has every where, though not equally, this

discomposing

discomposing property, having operated upon some of his companions, as well downwards as upwards. A greater proof of the power of the Streams upon the Body may be taken from the propagation of infectious Diseases, which being conveyed by insensible *effluvia*, from a sick into a healthy Body, are able to disorder the whole Oeconomy of it, and all those sad Tragedies, which Physicians do so often unsuccessfully endeavour to hinder. But you will cease to doubt that Corpuscles, though so small as to be below the sense, should be able to perform great matters upon humane Bodies; if you consider what alterations may be therein produced by the bare actions of the parts upon one another. This may appear by the effects of several Passions of the mind, which are often excited by the bare, if attentive, thoughts of absent things. In obstinate grief & melancholly, there is that alteration made in the disposition of the Heart, and perhaps some other parts by which the blood is to circulate, that the lively motion of that liquor is thereby disturbed, and obstructions and other not easily remov'd distempers are occasion'd. The bare remembrance of a loathsome Portion, does oftentimes produce in me (& I doubt not, but the like thought may have the like Operation in many others) a Horror, attended with a very sensible Commotion of divers parts of my Body, especially with a kind of conclusive motion, in or about the Stomach. And what power the Passions have to alter and determine the course of the blood, may appear yet more manifestly in modest & bashful persons, especially Women, when merely upon the remembrance or thought of an unchast, or undecent thing, mentioned before them, the motion of the Blood will be so determin'd, as to pass suddenly and plentifully enough in the Cheeks (and sometimes other parts) to make them immediately wear that liveliness of Virtue (as an old Philosopher styl'd it) which we call a Blush. And even by joy, if great and sudden, I not long since

*The power of
Streams seen in
the infectious
Effluvia.*

*Of alterations
made by the Pas-
sions of the mind.*

saw in persons of both Sexes, not only the cheeks and forehead, but it left (as to the Lady) even the neck and shoulders Died of that colour. And that Passions, may not only alter the Motion of the Juices of the Body, but likewise make some separation & evacuation of them, may appear in grief, which is wont, especially in women, to make all the commotions requisite to weeping: whereby oftentimes a considerable quantity of Briny liquor is excluded at the Eyes, under the form of Tears, by which divers (especially Hysterical) persons are wont to find themselves much refreshed, though with some it fares otherwise in teeming women. Also that vehement desire we call Longing, may well be supposed to produce great alterations in the body of the Mother, which leaves such strange and lasting impressions upon that of the Infant; since tis the Mother only, and not at all the Infant, that conceives those importunate desires.

C H A P. XIV.

*Divers instances
of the power of
Imagination.*

THere are many Instances to be met with in Physicians Books, to shew that Imagination is able so to alter the Imagining persons Body, as to work such a disposition in the Spirits, Blood & humors of it, as to produce the determinate Disease that is excessively feared. And I remember, that soon after the last Fair Lady R. died of the Small Pox, I chanced to meet one of her Sisters with her Mask on amongst some other persons of High Quality, and wondering to see her sit Maskt in such company, her Husband (who was present) told me, that his Wife having been happily brought to Bed some while before her Sister fell sick, he had carefully kept the knowledge of her sickness from his Wife, least the kindness that was betwixt them two might prejudice her in the condition she was in, but that after a while, a Lady unawares making mention in her hear-
ing

ing of her Sisters sickneſſe, ſhe immediately fancied that ſhe ſhould have it too, and accordingly fell ſick of that diſfiguring Diſeaſe, whoſe Marks obliged her for a while to wear a Mask. Nor is it in Women onely, but even in men, that Conceit may produce ſuch real and laſting effects. For many Authentick Hiſtories record Examples of thoſe, in whom exceſſive Grief or Fear has made ſuch a change in the Colour of their Hair in a Night, as Nature would otherwiſe have ſcarce made in divers years. And I remember that being about four or ſix Years ſince, in the County of *Cork*, there was an *Irish* Captain, a man of middle Age and Stature, who coming with ſome of his followers to render himſelf to your Uncle *Broghill*, who then commanded the *English* Forces in thoſe parts, upon a publick profer of pardon to the *Irish* that would then lay down Arms, he was caſually, in a ſuſpicious place, met with by a party of the *English*, and intercepted. And my Brother being then abſent upon a deſign, he was ſo apprehenſive of being put to Death by the inferior Officers, before your Uncles return, that that anxiety of mind quickly changed the Colour of his Hair after a peculiar manner: of which I (being then at that Caſtle of your Uncles whereunto he was brought) had quickly notice given me, and had the Curioſity to examine this Captain, and found that the Hair of his Head, had not (as in the Inſtances I had met with in Hiſtories) uniformly changed its Colour, but that here and there certain peculiar Tufts and locks of it, whoſe Baſes might be about an inch in Diameter were thus ſuddenly turned White all over: the reſt of his Hair (of which you know the *Irish* uſe to were good ſtore) retaining its former Reddiſh colour.

[You will miſtake my deſign, *Pyrophilus*, if you conclude from what I have ſaid, concerning the power of *Effluvia* to work upon the Body, that I am either ſo much an *Helmontian* as to condemn the uſe of all thoſe Remedies that make ſuch

An inſtance of
the hair of the
Head changed in
colour upon a
ſudden fear.

How the Authors discourse concerning the power of Effluvia ought to be understood.

such more grosse Evacuations (if I may so call them) as are made by Vomit, Seige, & the like; or that I would have you, or am my self so credulous, as to believe all the virtues that are even by eminent Writers ascribed to the remedies called Specificks: For (to mention here but this) we have observed, that the hopes built upon even excellent Specificks, unlesse they be of such a resolving and absterfive Nature, as to be able to make way for themselves into the recesses of the Body, are oftentimes disappointed, where some Emetick or Cathartick Remedy has not been first us'd to free the Stomack and Guts from those viscous Humours, which obstructing the first passages much enervate the virtue of the Remedy, if they do not altogether deny it access to the innermost parts of the Body. That then which I aim at, is first to keep you from being prejudiced by the confidence of some Learned Doctors, who laugh at the very name of Specificks, and will not allow any Disease to be curable, but by visible Evacuations of store of what they call peccant Matter; And next to give you cause to think that such Specificks, as men of judgment and credit do recommend upon their own Experience ought not to be rejected without Trial, upon the bare account of their not being either Laxative or Vomitive, Sudorifick, or Diuretical; Nay, nor so much as for this, that they are not endow'd with any Eminent degree of any manifest Quality, such as Heat, Cold, Driness, Odor, Taste, Astringency, and the like, nor able per chance to work any considerable alteration in a healthy humane Body. For I consider the Body of a living Man, not as a rude heap of Limbs and Liquors, but as an Engine consisting of several parts so set together, that there is a strange and conspiring communication betwixt them, by virtue whereof, a very weak and inconsiderable Impression of adventitious matter upon some one part may be able to work on some other distant part, or perhaps on the whole Engine,

Engine, a change far exceeding what the same adventitious Body could do upon a Body not so contriv'd. The faint motion of a mans little finger upon a small piece of Iron that were no part of an Engine, would produce no considerable Effect; but when a Musket is ready to be shot off, then such a Motion being applied to the Trigger by virtue of the contrivance of the Engin, the spring is immediately let loos, the Cock falls down, and knocks the Flint against the Steel, opens the Pan, strikes fire upon the Powder in it, which by the Touch-hole fires the Powder in the Barrel, and that with great noise throws out the ponderous Leaden bullet with violence enough to kill a Man at seven or eight hundred foot distance. And that also the Engine of an Humane Body is so fram'd, as to be capable of receiving great alterations from seemingly slight impressions of outward Objects, upon the bare account of its particular contrivance, may appear by several instances beside those which may belong to this Argument in the foregoing part of this E S S A Y. When a man goes suddenly out into the Sun, it often happens, that those beams which light upon the head, and would not in so short a time have any discernable effect on the least hair of it, do almost in a moment produce that strange and violent motion in the head and almost all the Body, which we call sneezing. Men that from the top of some Pinacle, or other high and steep place do look down to the bottom of it, are at first very apt by the bare prospect, (which yet conveys nothing into the body but those images if yet there intervene corporeal ones in sensation of visible objects that enter the Eye) to become so giddy, that they are reduced to turn away their Eyes from the Precipice, for fear of not being able to stand upon their Legs. And many that look'd fixedly upon a Whirl-pool, or upon a very swift stream have had such a vertiginous motion thereby impressed on their Spirits, that they have been unable to keep

That the particular state and disposition of the Engine of an humane body is considerable as to the effects of these impressions.

keep their Bodies upright, but have fallen into the Water they gazed on. And it is no lesse remarkable, that when a man is somewhat discompos'd at Sea, and yet not enough to Vomit freely; the Seamen are wont to advise him to look from the side of the Ship upon the Water, which seeming swiftly to passe by the Vessel, has upon the Gazer the operation of a rapid stream, and by making him giddy hastens and facilitates his Vomiting, as I have sometimes tried upon my self when I had a mind for healths sake to be put into a fit of Sea-sicknesse. If a person be very ticklish, and you but gently stroke the Sole of his Foot with the top of a Feather, that languid Impression on the bottom of the foot, shall, whether he will or no, put all those Muscles and other parts into motion, which are requisite to make that noise, and to exhibit that shape of the face (so far distant from the feet) which we call Laughing; and so the gentle Motion of a Straw, tickling the Nostrils, is able to excite Sneezing. Most men may observe in themselves, that there are some such noises, as those made by the grating of an ungreas'd Cart-wheel upon the *Axle-tree*, or the tearing of coarse Paper, which are capable of setting the Teeth on edge, which yet cannot be done without exciting a peculiar Motion in several parts of the Head. I had a servant, who sometimes complained to me of a much more remarkable and unfrequent disorder; namely, that when he was put to whet a Knife, that stridulous motion of the Air was wont to make his Gummies bleed. *Henricus ab Heer* (in his twenty ninth Observation) records a Story of a Lady, to whom he was sent for, who upon the hearing of the sound of a Bell, or any loud noise, though singing, would fall into fits of Sounding, which was scarce distinguishable from Death, and we may confirm that this disposition depended upon the Texture of her Body in reference to material sounds, by what he subjoyns, that having well purg'd her, & giving her for two Months

months the *Spaa*-waters, and other appropriate Remedies he through cur'd her. And it often enough happens, that when a Woman is in a fit of the *Mother*, another Hyfterical person standing by, is, by reason of a peculiar Disposition of her body, soon infected with the like strange discomposure. And to shew you, that a distemper'd body is both an Engine, and also an Engine disposed to receive alterations from such Impressions as will make none on a sound body, let me put you in mind that those subtle Streams that wander through the Air before considerable changes of Weather disclose themselves, are wont to be painfully felt by many sickly persons, and more constantly by men that have had great bruises or wounds in the parts that have been so hurt; though neither are healthy men at all incommodated thereby, nor do those themselves that have been hurt, feel any thing in those sound parts, whose Tone or Texture has not been alter'd or enfeebl'd by outward violence. I have known several also (and the thing is obvious) whose bodies and humours are so fram'd and constituted, that if (as men commonly speak) they ride backward in a Coach, that motion will make them giddy, and force them to vomit. And it is very ordinary for Hyfterical Women to fall into such Fits as counterfeit Epilepsies, Convulsions, and I know not what violent Distempers by the bare smell of Musk and Amber, and other strong Perfumes, whose steams are yet so far from having great, much less *such* Effects in other Humane bodies, that almost all men, and the generality even of healthy Women are not affected by them, unless with some innocent delight. And that even on men, Odours (how minute and invisible bodies soever) may sometimes have very great power, may be gathered from the story told us by *Sacutus Lusitanus*, of a Fisherman, who having spent all his life at Sea, and being grown Old there, and coming to gaze upon a solemn reception made in a Maritime Town, to *Sebastian King of Por-*

*In Pr. Med.
adm l. 3. Obser.
ut. 99.*

tugal, was, by the perfumes plentifully burnt, to welcome the King, immediately cast upon the ground thereby into a fit, which two Physicians judg'd Apoplectical, and Physick'd him accordingly, till three days after the Kings chief Physician, *Thomas à Vega*, gueffing at the cause of the disease, commanded him to be remov'd to the Sea-side, and cover'd with Sea-Weeds, where, within four hours, the Maritime Air and Steams began to open his Eyes, and made him know those that were about him, and within not many dayes restor'd him to health. We may also conjecture how much the alteration produced in the body by sickness may dispose it to receive strong Impressions from things that would not otherwise much affect it, by this, That even a man in perfect health, and who is wont to Drink cold without the least harm, may, when he has much heated himself by exercise, be cast by a draught of cold Drink into such sudden, formidable and dangerous distempers, as, did not daily Experience convince us, we should scarce think possible to be produced in a Body, free from Morbid Humours, by so familiar a thing as a cup of small beer or water; insomuch that *Benivinius* relates a story of one, who after too vehement exercise drinking a Glass of very cold Water fell into a swoon, that was quickly succeeded by Death. And yet, to adde that on this occasion, in bodies otherwise dispos'd, a large draught of cold Water, drunk even without thirst, may very much relieve the Drinker, and prevent great fits of the Mother, and partly of the Spleen, especially upon suddain frights, to which purposes I know some Hysterical Ladies that find in this Remedy, as themselves assure me, more advantage than one would easily imagine.

And (further) to shew you that the Engine we are speaking of is alterable, as well for the better as for the worse, by such Motions of outward Bodies, as, in themselves consider'd, are languid, or at least may seem despicable

or in reference to sicknes or recovery; let me call upon you to consider a few, not unobvious, things, which may also serve to confirm some part of what has hitherto been deliver'd.

[The true Mosse growing upon a Humane skull, though I do not find Experience warrant all the strange things some Chymical Writers attribute to it for the stanching of Blood, yet I deny not, but in some Bodies it does it wonderful enough. And I very well know an Eminent *Virtuoso*, who has assur'd me, as his Physician likewise has done, that he finds the Effects of this Moss so considerable upon himself, that after having been let blood, his Arme falling to bleed again, and he apprehending the consequences of it, his Physician, who chanc'd to be present, put a little of the above-mention'd Moss into his hand, which barely held there, did, to the Patients wonder, stanch his Blood, and gave him the curiosity to lay it out of his hand, to try whether the Moss were the cause of the Bloods so oddly stopping its course; whereupon his Arm, after a little while, beginning to bleed afresh, he took the Moss again into his hand, and thereby presently stancht his bleeding the second time: and, if I misremember not, he added, that he repeated the Experiment once more with the like success. The smoak of burnt feathers or Tobacco blown upon the face of an Hysterical Woman, does oftentimes almost as suddenly recover them out of Fits of the Mother, as the Odour of Perfumes did cast them there-into.]

The Effects of the Moss growing on a human Skull in stanching blood.

Burnt feathers, or the smoak of Tobacco removes Hysterical fits.

And now I speak of Cures performable by Fumes, it brings into my mind, that a friend of yours and mine, and a person of great Veracity professes to have strangely cur'd Dysenteries by a way usual enough, which is to make the Patient sit over a Chair or Stool close on the sides, and perforated below, so that the *Anus* and the neighbouring parts may be expos'd to the fumes of Ginger, which must be thrown upon a Pan of Embers, plac'd just under the Patient,

Cures of Dysenteries by Fumes.

who is to continue in that posture, and to receive the Fume, as long as he can endure it without too much fainting. And when I mention'd one of the Cures that was thus perform'd, to one that is lookt upon as a Master of Chymical *ARCANA* against Diseases; he preferr'd before it (as he saies upon experience) the Shavings of Harts-Horn us'd after the same manner, and the Remedy seems not irrational. But if in this distemper, the actual Heat applied to the above mentioned part of the body concur not to the Effect, we may too, warrantably enough, adde, that Cures may be perform'd by far more minute corpuscles than those of smoak, insinuating themselves from without into the body. For I know a very dextrous Goldsmith, who, when he oerheats himself, as he often unawares does at hammering of Plate, is subject to fall into Gripings of the Belly, which lead to Fluxes; but his usual and ready Cure is, as soon as conveniently he can, to heat his Anvil, and sit upon it for a great while together, heating it hot again if there be need. But to return to our Medicinal Smoaks,, tis known that some find more good against the fits of the Colick, the Clysters of the Smoak of *Tobacco*, than by any other Physick they take; so that I know wealthy persons, that relying upon the benefit they find by this Remedy, have left off sending for their Physitians to ease them of the Colick. And indeed, when I consider what an odde Concrete, even common Soot is, and that many Concretes, by being resolv'd into Smoak, may be either more or otherwise unlockt, then they would be by the Stomach of a Man (so that I may elsewhere entertain you of the great heightning of some Emetick and Cathartick Simples in their operation, by their being reduc'd into Smoak) and that also probably the Operation of some Fumes and Odours; may be much chang'd and improv'd by their not getting into the body by the Mouth, but other parts; I am inclinable to think that there might be made further use of them, if Physicians

*And by sitting on
a hot Anvil.*

*Cures of the Co-
lick by Clysters
of the smoak of
Tobacco.*

*Of other Cures
done by Smoaks.*

ficians pleas'd, than hitherto has been. For I have made such trial of the Virtue of Sulphureous Smoak, to preserve some Liquors, as I was much pleas'd with. And not only *Paracelsus*, but *Helmont* highly extols, as a grand Specifick in fits of the Mother, the Smoak of the Warts that grew upon the Legs of Horses, convey'd to the parts suppos'd to be primarily affected. And I remember, that lately I met with a Gentleman curious and intelligent, who, as himself assur'd me, was by the Scurvy and ill condition'd Ulcers, and other obstinate distempers brought so low, that he was scarce able to turn himself freely in his Bed, and thereupon resolv'd against taking any more Physick, partly out of despair of recovery, and partly of weariness of the tedious courses of Physick the Doctors had in vain made him passe through: But that some of his friends bringing him a certain Surgeon, whom they affirm'd to have strangely cur'd many desperate distempers, by wayes very unusual and not troublesome to the Patient, this Gentleman was content to put himself into his hands; the Surgeon promising that he would not give him any other Physick, but now and then a Cup of Sack by way of Cordial; his way of Cure being to fumigate the Patient very well every morning with a certain Smoak, which that Gentleman thinks, by what he took notice of, in the Powder that yielded it, to have been some Vegetable substance. And with this remedy in a short time he grew perfectly well, and came home a while since in very good health from a Voyage, which the confusions of his own Country invited him to make as far as the *East-Indies*. This Surgeon, whose name I cannot hit upon, dying suddenly, his secret (which was try'd upon divers others besides this Gentleman) is, for ought we know, dead with him.

[But as for the efficacy that may be found in appropriated Fumes and Steames: we have more than once, by barely unstopping and holding under her Nose a small Phial of highly rectified

rectified Spirit of Sal-Armoniack, or even of Harts-horn almost presently recover'd a Young Beauty, I need not name to You, out of strange fits that were wont to take her more suddenly than those of the Falling-sickness, and were lookt upon as Epileptical, though perchance they were not meerly so. To which I shall adde, that a Lady that both You, *Pyrophilus*, and I know & love very well, though she have been long subject to violent and tedious Fits of the Head-ach, and though that distemper hath been much increas'd by a great concussion of her Head, occasion'd by the overturning of a Coach, yet she is wont presently to be relieved, barely by holding her Head a pretty while over a strong decoction of *Thee*, and breathing in the Steams of it.]

Of the sudden
easing of the
Plague at Grand
Cayro in June.

And now I am discoursing of Cures made by Steames, or other seemingly slight means, I must not pretermit a thing so remarkable, that if it were more generally known in Europe, I shall think it somewhat strange to find it so little reflected on by Physicians; and that is, the constant and almost sudden easing of the Plague, how raging soever, in the almost incredibly populous city of the *Grand Cayro* in Egypt towards the latter end of *June*, about which time in most Countries in our Hemisphere it is wont to spread fastest and be most rife. The truth of this is attested by so many Travellers of several Nations, that 'twere injurious to doubt of it, and not only the dexterous Mr. R. whom you well know, and who lived at *Cayro*, has confirm'd to me the truth of it, but the Learned *Prosper Alpinus*, who both was an excellent Physitian, and spent many years in Egypt, gives us this particular account of it: *Pestis Cayri atq; in omnibus locis Egypti invadere eos populos solet incunte Septembri mense, usq; ad Junium: his enim omnibus mensibus, à Septembri ad Junium usq;, Pestis aliunde per contagium illuc asportata eam gentem invadere solet.* And after a few lines, *Junio vero mense, qualiscunq; & quantacunq; sit ibi Pestilentia, Sole pri-*

De medicina
Egyptiorum.
lib. 1. cap. 17.

nam *Caucr*i partem ingrediente, omnino tollitur, quod multis
 planè divinum esse non immeritò videtur: sed quo etiam val-
 de mirabile creatur, omnia supellectilia, Pestifero contagio
 infecta tunc nullum Contagii effectum in eam gentem edunt;
 ita ut tunc ea vobis in tutissimo & tranquillissimo statu reduca-
 tur ex summè morboſo: atq; morbi particulares, sporadici, à
 Grecis vocati, tunc apparere incipiunt, qui nusquam gentium
 tempore Pestis apparebant. And in the next chapter, inqui-
 ring at large into the causes of this Wonder, he denies it to
 proceed from the increase of the Nile, which happens to be
 coincident in point of time with the extinction of the Plague,
 because that the Infection ceaseth before the swelling of the
 River is considerable; and ascribeth it rather to the altera-
 tion of the Air, produc'd by the Northerly Winds, which
 then begin to blow, and some other Circumstances: speak-
 ing of which, *Hæc* (saith he) *per id temporis incipiunt obser-*
vati à quibus fortasse non immeritò causam extinctionis Pestis
morbosiq; in salubrem statum mutationis pendere arbitror:
quando nulla aliis ex conservatricibus causis, quas vulgus medi-
corum res non naturales appellat, aëre excepto, ibi eo tempore
appareat, in quam morboſi status in salubrem mutationem re-
ferre possumus: ideo necessarium erit hujusce mutationis causam
Aeris mutationi acceptam referre, &c. Upon this Instance,
Pyrophilus, I have presum'd the longer to insist, because
 (if you duly reflect on it) you will, I suppose, discern, that
 it much credits and elucidates à great part of what hath been
 delivered in divers of the foregoing Leaves, concerning the
 possibility of Natures doing great Matters against Diseases,
 without the help of grosse and sensible Evacuations.

Ibidem c. 182.

CHAP. XV.

That Human body may be altered by such Motions as act in a Grofs and meerly Mechanical manner, proved by divers Instances.

AND since we have represented a humane body as an Engine, we shall adde, that it may be altered both for the better and for the worse, by such bare motions or impulses of external Bodies, as act but in a grosse and confessedly Mechanical manner. For tis known, that out of such speedily killing (unlesse seasonably remedied) Distempers, as fits of Swouning, Patients of either sex are often recovered without any inward Medicine, by being barely pincht in several places. I, that have endured great and dangerous Sickneses, have scarce ever found any so violent for the time, as that which the bare motion and smell of a Ship and Sea-air hath put me into, especially in rough weather, till I was somewhat accustomed to Navigation; and yet this violent and weakening Sicknesse, as it was not produced by a peccant humor in the Body, so it was quickly removed by the Air, and Quiet of the Shore, without the help of Physick. And the like may be observed more suddenly in the newly mention'd Instances of those, in whom the bare agitation of a Coach will produce such violent Fits of Vomiting, and such Faintnesse, that I have known some of them apprehend they should presently die; so the bare cessation of that discomposing motion soon relieved them. We see in our Stables; what operation the Currying of them carefully hath upon our Horses. And *Helmont* somewhere tells us, that himself, as I remember, could by the milk of an Ass, tell whether she had been that day diligently curried or no; and so considerable an alteration in Milk should me thinks strongly argue, that a great one is in the Blood or other Juice, of which the Blood is elaborated, and consequently in divers of the principal parts of the body must have preceded it. But to prefer our consideration from the bodies of Beasts to those

those of Men, tis remarkable what *Piso* confesseth, the illiterate *Brasilian* Empericks are able to perform with Frictions, even as unskilfully as they order them: *Mira equidem*, saith he, *tum tuenda sanitatis ergo, cum in plerisque morbis sanandis, fractione & unctiōe frequenti incola praestant, illam* Histor. Nat. Med. lib. 2. cap. 5 p. 33. *frigidioribus, & chronicis, hanc in acutioribus adhibentes.*

Qua remedia lubenter advena imitantur, & ut par est, ex legibus artis hac & plura medendi Empericorum genera moderantur. And as *Galen* himself highly extols a skilful Application of Cupping-glasses in the Colick; so in *Brasil* they find that the like Remedy is strangely successful: For *Cholera sicca*, saith our Candid *Piso* in another place, *eisdem ferè Remediis* (of which he had been speaking) *curatur, maxime* Idem cap. 11. *si regioni hepatis cornea cucurbitula applicentur. De quibus merito hoc testor, quod Galenus de suis cucurbitulis, quas in Colico affectu incantamenti instar operari tradidit.*

We shall adde, for further confirmation, that notwithstanding all the horrid Symptoms that are wont to ensue upon the biting of that Poysonous Spider, the *Tarantula*, that lasting and formidable Disease, which often mocks all other Remedies, is by nothing so successfully oppos'd, as by Musick. Some determinate tune or other, which proves suitable to the particular nature of the Patients body, or that of the Poyson producing there such a motion, or determination of some former motion of the Spirits, or the Humours, or both; as by conducting the Spirits into the Nerves and Muscles inservient to the motion of the Limbs, doth make the Patient leap and dance till he have put himself into a Sweat, that breaths out much of the virulent Matter which hath been probably fitted for Exdulsion, by some change wrought in its Texture or Motion, or those of the Blood, by the Musick. For if Sweat and Exercise, as such, were all that relieved him, why might not *Sudorifics*, or leaping without Musick, excuse the need of *Fidlers*? which yet is

The Instances of the Cure of the Tarantula by Musick particularly modified.

Musurg. lib. 9. cap. 4. so great, that *Kircher* informes us, That the *Apulian* Magistrates are wont to give Stipends, at their publick charge, to such, to relieve the Poor by their playing. And not onely he hath the memorable story of *Robertus Pantanus*, a *Tarentine* Nobleman, whose Disease being not known to proceed from the biting of a Spider, could by no Remedies be cured; he was at length, even upon the point of death, suddenly reliev'd, and by degrees restored to perfect health by the use of Musick: But *Epiphanius Ferdinandus*, in his accurate Observations concerning those bitten with the *Tarantula*, together with *Mathiolus*, and other Authors bear witness thereunto, by resembling Narratives. Now that a Sound (not barely as a Sound, but so modified) may powerfully operate upon the Blood and Spirits, I, who am very Musically given, have divers times observ'd in my self, upon the hearing of certain Notes. And it might be made probable, both by that which we have formerly said of the effect of skreaking upon the Teeth and Gums, and by the Dancing Fit, into which not every Musical Sound, though never so loud, but some determinate Tune is wont to put the bitten Patient: But it may be more manifestly prov'd, by the following testimony of our inquisitive Jesuite, wherein he affirms, That the Spiders themselves may, as well as those they have bitten, be made to dance by Tunes suited to their peculiar Constitutions. *

* ubi sonatores
qui Musica sua
hoc malum etiā
publicis magi-
stratus stipendi-
is ad Pauperum
remedium soliti-

umq; conducti curare consueverunt, ad curas Patientium certius faciliusq; accelerandas; primò ex infestis quærere solcat ubi, quo loco, aut campo, aut cujus coloris Tarantula erat, à quo morsus ipsis sit infestus. Quo facto indicatum locum protinus, ubi frequentes numero atque omnis generis Tarantula relictum texendorum laboribus incumbunt, accedere solent Medici Citharedi, variaque tentare harmoniarum genera: ad quæ (mirum dictu) nunc has nunc illas saltare non secus ac daorum polychordorum æqualiter concinnatorum, personatione illæ chordæ, quæ similes sibi fuerint tono, & æqualiter tensæ moveantur, reliquis imotis, ita ut pro similitudine & conditione Tarantularum nunc has nunc illas saltare comperiant. Cum vero ejus coloris Tarantulum, quæ à Patientibus indicata fuerit, in saltum prorumpere viderint, pro certissimo signo habent, modulum se habere verum & certum, humori venenoso ita re-extracto & proportionatum, & ad curandum aptissimum, quo si utantur infallibilem curæ effectum se consequi assueverunt. *Kircher. Musurg. lib. 9. pars. 2. cap. 4.*

And this I the lesse wonder at, because *Epiphanius Ferdinandus* himself, not onely tels us of a man of 94 Yeares of age, and so weak that he could not goe, unlesse supported by his Staff, who did, upon the hearing of Musick after he was bitten, immediately fall a dancing and capering like a Kid; and affirms, that the *Tarantula's* themselves may be brought to leap and dance at the sound of Lutes, small Drums, Bagpipes, Fiddles, &c. but challenges those that believe them not, to come and try, promising them an Ocular conviction: and adds what is very memorable and pleasant. That not onely men, in whom much may be ascribed to fancy, but other Animals being bitten, may likewise, by Musick, be reduc'd to leap or dance: for he saith, he saw a Wasp, which being bitten by a *Tarantula* whilst a Lutanist chanced to be by; the Musician playing on his Instrument, gave them the sport of seeing both the Wasp and Spider begin to dance: annexing, That a bitten Cock did the like.

C H A P. XVI.

I Might also, *Pyrophilus*, confirm what I told you, when I said, that Sicknesse may produce such an alteration in the Fabrick of the Body, as to make it capable to be very much affected, as well for the better as for the worse, by such things that would not scarce at all affect it if it were sound, from the consideration of those many and strange *idiosyncrasies* or *Peculiarities*, to be met with in some Persons in Sicknes and in Health. For though many of these differenees between healthy men, are not likely to be greater than may be observ'd between the same man when well, and himself as the Oeconomy of his Body may be discomposed by some Distemper; yet we often see, that some Persons have the Engine of their Body so fram'd, that it is wonderfully disordered by such things as either work not at all on others, or

Divers Instances of the idiosyncrasies, or peculiar aversion of particular persons from particular things, and of the Commotions made in the body thereby.

work otherwise on them. as it is common enough for men to be hugely disturb'd, and some of them to fall into Fits of trembling and swooning, upon the sight or hearing of a Cat. And to such an affection I know a very eminent Commander obnoxious, your late Unkle, the last Earl of *Barrymore*, a very gallant Noble Man, and who did his Countrey great Service in the Irish Wars, had the like apprehension for *Tansy*. I cannot see a Spider neer me, without feeling a notable commotion in my Blood, though I never received harm from that sort of Creature, and have no such abhorring against Vipers, Toads, or other Venemous Animals. You know an Excellent Lady (married to a great Person that hath more than once Govern'd *Ireland*) whose Antipathy to Honey, which is much talkt of in that Countrey, hath display'd it self upon several occasions: notwithstanding which, her Experienc'd Physitian imagining that there might be something of deceit in her Aversion, took an opportunity to satisfie himself, by mixing a little Honey with other Ingredients, of a Remedy which he applied to a very slight and inconsiderable Cut or Scratch, which she chanced to get on her Foot, but he soon repented of Curiosity, upon the strange and unexpected Disorder which ceasing upon the removal of that, and application of other ordinary Remedies, satisfied him, That those Symptoms were to be imputed to the Honey, and not the bare hurt. The same Excellent Lady, I remember, complained to me, That when she was troubled with Coughs, all the Vulgar Pectoral and Pulmoniack Remedies did her no good, so that she could find relief in nothing but either the Fume of Powderd Amber, taken with convenient Herbs in a Pipe, or that *Balsamum Sulphuris* which we have already taught You in this Essay.

I know a person of Quality, tall and strong made, who lately asked my Opinion, Whether, when he had need of a Vomit, he should continue to make use of *Cauphy*, in regard it wrought so violently with him: This gave me the occasion, as well as Curiosity, of enquiring particularly both of Himself and his Lady, concerning this odde Operation of *Cauphy* upon him; and I was told, That an ordinary Wine-glasse full of the usual warm decoction of *Cauphy*, boyl'd in common Water, was wont, within about two hours, to prove Emetick with him, and before Noon did give him eight, ten, or sometimes twelve Vomits, with so much violence, that he was lesse affected by the Infusion of *Crocus Metallorum*, or other usual Emeticks, and therefore was deliberating whether he should not change *Cauphy* for some of them, though finding its Operation very certain, he had for some Years accustomed himself to take that Vomit: And that which is also remarkable in this matter, is, that he tels me, That scarce any Vomit is more troublesome to him to take, then that above mentioned is grown of late, so that even the odour of *Cauphy*, as he passeth by *Cauphy*-houses in the Street, doth make him sick; and yet that Simple is to most of men so far from being Vomitive, that it is by eminent Physitians, and in some cases not without cause, much extoll'd as a strengthner of the Stomach. And this very Gentleman himself, used it a pretty while against the Fumes that offended his head, without finding any Vomitive Quality at all in it.]

The Books of sober and learned Physitians afford us Examples of divers such, and of much more strange Peculiarities, and likewise of such Persons, who having desires of certain things very extravagant, and even absurd, (ordinarily not onely improper, but hurtful to their Distempers) have been cured by the use of them, of very dangerous and sometimes hopelesse Diseases: Of which kind of Cures I may also

also elsewhere tell you what I have observed, and some credit may be brought to such Relations, by what we ordinarily see more greedily devoured (without much harm) by longing Women, and Maids troubled with the Greenickness.

That since the Body receives such alterations from such unlikely things, there is no just arguing against Specificks, because they operate not by any obvious Qualities.

But now, *Pyrophilus*, since the Engine of an humane Body thus appears to be so fram'd, that it is capable of receiving great alterations from such unlikely things as those we have been mentioning; why should we hastily conclude against the efficacy of Specificks, taken into the Body, upon the bare account of their not operating by any obvious quality, if they be recommended unto us upon their own experience by sober and faithful Persons? And that scarce sensible quantities of matter, having once obtained access to the masse of Blood (which is very easily done by the Circulation) may, by the contrary and swift motion, and by the Figure of the Corpuscles it consists of, give such a new and unnatural impediment or determination to the motion of the Blood, or to discompose either its Texture, or that of the Heart, Brain, Liver, Spleen, or some such principal part of the Body (as a spark of fire reduceth a whole Barrel of Gunpowder, to obey the Laws of its Motion, and become Fire too; or as a little Leaven is able, by degrees, to turn the greatest lump of Dow into Leaven) need be manifested by nothing, but the Operations of such Poysons, as work not by any of those (which Physitians are pleased to call) *Manifest Qualities*. For though I much fear, that most of those that have written concerning Poysons, supposing that men would rather believe then try what they relate, have allowed themselves to deliver many things more strange then true; yet the known effects of a very small quantity of *Opium*, or of *Arsenick*, of the scarce discernable hurt made by a Vipers Tooth, and especially of the biting of a mad Dog (which sometimes, by lesse of his Spittle then would

would weigh half a Grain , subdues a whole great Ox into the like madnesse, and produceth truly-wonderful Symptoms both in Mens bodies and Beasts) are sufficient to evince what we propos'd.

And that Man's body may be as well sometimes cured, as we see it too often compos'd, by such little proportions of Matter, may (not now to mention the questionable Vertues ascrib'd to many Antidotes) be gathered from that Experiment, so common in *Italy* and elsewhere, of curing the venom'd biting of Scorpions, by anointing the bitten and tumid place with common Oyl, wherein store of Scorpions have been drown'd and steep'd. And a resembling Example of the Antidotal Virtue, wherewith Nature hath enricht some Bodies, is given us by the above-commended *Piso*, in his *Medicina Brasiliensis*, where (treating of the Antidotal Efficacy of the famous *Brasilian* Herb *Nhanby*, eaten upon an empty Stomach) he adds this memorable Story; That he himself saw a *Brasilian*, who having caught an over-grown Toad, and swell'd with Poyson (such a one as *Brasilians* call *Curnu*) which useth to be as big again as the *European* Toad, and desperately venomous (which perhaps our Toads are not) he presently killed him, by dropping on his back the juice of the Flowers and Leaves of that admirable Plant. And you may remember, that the same Author formerly told us, in effect, that as great and salutary changes may be produced even in humane Bodies, where he relates, That he had known those that had eaten several sorts of Poyson, snatcht in a trice from imminent death, by onely drinking some of the Infusion of the root he callis *Faborandis*, and this, after I know not how many *Alexipharmaca* and *Theriacal* Antidotes had been fruitlessly administred.

You will perchance tell me, *Pyrophilus*, that these three or four last Instances are of Poysonous Distempers and their Antidotes; not of ordinary Diseases, and their Specifick Remedies.

medies. But to this I have a double Answer: and First, many of those distempers that proceed from Poyson, are really Diseases, and both call'd by that Name, and treated of as such, by Physitians. And indeed they may well look upon them but as Diseases, exasperated by a virulent Malignity, which yet appears to be not alwaies easily distinguishable from that of Diseases that proceed not from Poyson, by this, That otherwise the Physitians of Princes and Great men, if after having considered all the inward parts of their dis-bowell'd patients, could not so often doubt and dispute, as they doe, whether or no Poyson were accessary to their death. And P^{iso} (who learnt divers of their detestable Secrets from the *Brazilians*) relates, That some of them are so skilful in the cursed Art of tempering and allaying their Poysons, that they will often hinder them from disclosing their Deleterial Nature for so long a time, that the subtle Murtherers do as unsuspectedly as, fatally, execute their malice or revenge. These Diseases indeed are wont to differ in this from Surfeits, and other resembling ordinary diseases; that in the one, the venomous matter that produceth the disease, is at first much more small, than in the other the morbidick matter is wont to be. But the activity of this little quantity of hostile matter doth make it pernicious, that the Disorders it produceth in the Body, being much greater than that of ordinary Sickneses is; the cure of such Distempers is the fitter to manifest how powerfully Nature may be succour'd by Remedies that work not by first or second Qualities, since such are able to deliver Her from Diseases heightened by a peculiar and venomous malignity.

To this first I shall subjoyn my next, which is, That divers passages of the former Discourse (especially what we have related concerning the cure of Agues, of the Rickets, and of the Kings-Evil) may satisfie You, That even of ordinary Diseases (some at least) may be as well cured by Specificks,

sicks, as those produced by Poyson are by Antidotes:

You may also say, *Pyrophilus*, But what if a recommended Specifick do not onely seem unable to produce the promised Effect, but have Qualittes, which according to our Notions of the nature of the Disease, seem likely to conspire with it and increase it?

I Answer,

First, That though it is better for the Patient to be cured by a rashly and unskilfully given Medicine, than to die under the use of the most skilfully administred Physick; yet that the Physitian who looseth his patient, after having done all that his Art prescribed to save him, deserves more commendation then he that luckily chanceth to cure his patient by an irrational course. And therefore in such a case as you put, *Pyrophilus*, I think the Physitian ought to be very well satisfied to the matter of fact, before he venture to try such a Remedy, especially if more ordinary & unsuspected means have not been imployed and found ineffectual; for it is not one lucky Cure that ought to recommend to a wary Physitian the use of a Remedy, whose dangerous Quality seems obvious, whereas its virtue must be credited upon Report.

But then secondly, If the Physitian be duely satisfied of the efficacy of the Remedy, upon a competent number and variety of Patients, I suppose he may, without rashnesse, make use of such Remedies, at least where ordinary Medicines have been already fruitlessly try'd.

What is to be done when the Specifick seems likely to increase the Disease.

C H A P. XVIII.

THAT You may cease to wonder at my daring to say this, *Pyrophilus*, I must offer to you Three or Four particulars.

And First, it is manifest to those that are inquisitive, That

K k

the

A Disquisition
concerning the
ordinary method
of Physick.

the true Nature and Causes of several Diseases, are much lesse certain, and much more disputed of amongst the Doctors themselves, then those that are not inquisitive imagine: Nor is the method of curing divers particular Diseases more settled and agreed on; That depending chiefly upon the knowledge of those Causes, which, as I was saying, are controverted. Tis not that I am either an enemy to Method in Physick, or an Undervaluer of it; but I fear the generality of Physicians (for I intend not, nor need all along this Essay speak of them all) have as yet but an imperfect Method, and have by the narrow Principles they were taught in the Schools, been perswaded to change their Method rather to the barren principles of the *Peripatetick* School, than to the full amplitude of Nature. Nor do I find that Physicians have yet done so for a thing, as seriously (& with the attention which the importance of the thing deserves) on the one side, to enumerate and distinguish the several Causes, that may any whit probably be assign'd; how the *Phænomena* of that disordered state of humane Body, which we call a Disease, or its Symptoms, may be produced. And on the other side, by how many and how differing wayes the *Phænomena* may be removed, or the Diseases they belong to destroyed: And if this were Analytically and carefully done, I little doubt but that mens knowledge of the Nature and Causes of Diseases, and the ways of curing them, would be lesse circumscrib'd, and more effectual than now it is wont to be. And I am apt to think, that even Methodists would then find, that there are divers probable, if nor promising Methods (proper to divers cases) which ways they yet overlook. And though in a right sense it be true, that the Physician is but Natures Minister, and is to comply with Her, who aims always at the best; yet if we take them in the sense those Expressions are vulgarly used in, I may elsewhere acquaint You with my Exceptions at them, & in the mean time confess to you, That

I know not whether they have not done harm, and hindred the advancement of Physick, fascinating the minds of Men, and keeping them from those effectual Courses, whereby they may potently alter the Engine of the Body; and by rectifying the Motion & Texture of its parts, both consistent and fluid, may bring Nature to their Bent, and accustom her to such convenient Courses of the Blood and other Juices, and such fit times and ways of evacuating (what is noxious or superfluous &c.) as may prevent or cure divers stubborn Diseases, more happily than the vulgar Methodists are wont to do.

And indeed, it is scarce to be expected, that till men have a better Knowledge of the Principles of Natural Philosophy, without which tis hard to arrive at a more comprehensive Theory of the various possible causes or Diseases, and of the contrivance and uses of the parts of the Body, the Method which supposes this Knowledge should be other than in many things defective, and in some erroneous; as I am apt to think, the vulgar Method may be shewn to be, as to some particular Diseases. Of this I may perhaps elsewhere acquaint you more particularly with my Suspicions, and therefore I shall now onely mention the last Observation of this kind I met with, which was a Gentleman, You and I very well know, who being for some Months much troubled with a difficulty of Breathing, and having been unsuccessfully treated for it by very eminent Physicians, we at last suspected that twas not the Lungs, but the Nerves that servd to move the Diaphragme and other Organs of Respiration, upon whose Distemper this suppos'd *Asthma* depended, & accordingly by a Taking or two of a Volatile Salt of Ours, which is very friendly to the *Genus Nervosum*, he was quickly freed from his troublesome Distemper, which afterwards he was fully perswaded did not proceed from any stuffing up of the Lungs, To be short, how much esteem soever

we have for method, yet since that it self and the Theories whereon men ground it, are, as to divers particular Diseases, so hotly disputed of, even among Eminent Physicians, that in many cases a man may discern more probability of the success of the Remedy, then of the truth of the received Notion of the Disease; In such abstruse cases methinks it were not amiss to reflect upon that reasoning of the Ancient Empericks (though on a somewhat differing occasion) which is thus somewhere exprest by *Celsus*: *Neg. se dicere consilio medicum non egere, & irrationabile Animal hanc artem posse prestare, sed has latentium rerum conjecturas ad rem non pertinere, quia non interfit, quid morbum faciat, sed quid tollat.* And as the controverted Method in the above mentioned Diseases is not yet established or agreed on in the Schooles themselves, so divers of those that are wholly strangers to those Schools, do yet by the help of Experience and good Specificks, and the method their Mother-wit does, according to emergencies, prompt them to take, perform such considerable Cures, that *Piso* sticks not to give this Testimony to the utterly unlearned *Brasilian* Empericks. *Interim, tales he, seniores & exercitiores eximii sunt Botanici, faciliq. negotio omnis generis medicamina ex undiquaq. in sylvis conquisitis conficiunt. Quae tanta sagacitate internè & externè illos adhibere videas, præcipuè in morbis à veneno natis, ut quæ illorum manibus tutius & securius se tradat, tuam medicastri nostris sciolis, qui secreta quadam in umbra nata atq. educata crepant perpetuo, & ob has Rationales aici volunt.*

Secondly, there are divers Medicines, which though they want not some one quality or other, proper to increase the Disease, against which they are administred, are yet confidently us'd by the most judicious Doctors, because that they are so enrich'd with other qualities, whereby they may do much more good than their noxious qualities can do harm; as in a malignant Feaver, though the distemper be Hot, and

though Treacle & some other Antidotal Sudorificks be hot also, yet they are usefully administred in such Diseases, because the relief they bring the patient by oppugning the Malignity of the peccant matter, and perhaps by easing him of some of it by Sweat, is more considerable than the harm they can do him, by increasing for a while his Heat.

Instances of
some Medicines
which are con-
demnd for No-
xious, and yet
have prov'd use-
ful.

The very Experienced *Bontius*, Chief Physician to the Dutch Plantation in the East-Indies, in his *Methodus medendi Indica*, treating of the *Spasmus*, which (though here unfrequent) he reckons among the Endemical Diseases of the Indies, commends the use of *Quercetanus's Laudanum*, of *Phyllocum*, and principally of an Extract of *Opium* and *Safron*, which he describes and much extols: and least his Readers should scruple at so strange a prescription, he adds this memorable passage to our present purpose. *Fortassis* (saies he) *Sciulus quispiam negabit his remediis, propter vim stupefactivam ac narcoticam nervisq; inimicam, esse utendum. Speciosa quidem hac prima fronte videntur, sed tamen vana sunt. Nam praterquam quod calidissima hujus Climatis temperies requirat, certissimum est in tali necessitate: sine his agrum evadere non posse. Adde quod nos tam rite Opium hic preparamus ut vel infanti innoxie detur: & sane (ut verbo absolvam) si Opium hic nobis deesset in morbis calidis his grassantibus frustra remedia adhiberemus, quod etsi imperitis durum, ex progressu tamen me nil temere dixisse patebit.*

Cap. 2.

The drinking freely, especially if the Drink be cold Water, is usually (and in most cases, nor without much reason,) strictly forbidden, as very hurtful for the Dropsie, and yet those that frequent the *Spaa*, tell us of great cures perform'd by pouring in plenty of Waters into the patients already distended Belly; and I know a person of great Quality, and Virtue, who being by an obstinate Dropsie, besides a complication of other formidable Diseases, brought to a desperate condition, was advis'd to drink *Tunbridg. waters*, when I happen'd

Of the use of
Guajacum for
Consumptions,
and Mercury for
Palsies.

happen'd to be there, by her very skilful Physician: who told me, that the Doctors having done all their Art could direct them unto in vain, she would be cur'd by Death, if she were not by these Waters; from whence (the weather proving very seasonable for that sort of Physick) she return'd in so prosperous a condition of recovery, as exacted both his and my wonder. That the Decoction of so heating a Simple as *Guajacum*, would be lookt upon by the generality of Physicians, both *Galenists* & *Chymists*, as a dangerous Medicine in Phthisical and other Consumptions, you will easily grant: and yet some eminent Physicians, and (particularly *Spaniards*) tell us of wonderful cures they have perform'd in desperate Ulcers of the lungs, by the long use of this Decoction, notwithstanding its manifestly and troublesomely heating Quality. And I know a Physician eminently learn'd, and much more a Methodist than a Chymist, who assures me, that he has made trial of this unlikely way of curing Consumptions with a success that has much recommended these Paradoxical *Spaniards* to him. 'Tis also believed, and not without cause by Physicians, that *Mercury* is wont to prove a great enemy to the *Genus Nervosum*, and often produces Palsies, and other distempers of the Brain in the Nerves: and yet one of the exactest and happiest Methodists I know, has confest to me, that *Mercurial* preparations are those which he uses the most successfully in *Paralytical* and the like Distempers of, what Physicians call, the *Genus Nervosum*. And on this occasion, I remember that a Gentlewoman being confin'd to her Bed by a Dead-palsey, that had seiz'd on one side of her Body, a Physician eminent for his Books and Cures, giving her a Dose of a certain preparation of *Mercury*, corrected with a little Gold, which I put into his hands for that purpose, was pleas'd to bring me word, that by the first taking of the Powder, which wrought but gently by Siege without either Vomits or Salivation, she was enabled the same

same or the next day to quit her Bed, and walk about the Room.

Thirdly, there are many things which seem to be against Reason, whilst they are barely propos'd and not prop'd, for which we afterwards discern very good reason: when experience having satisfied us they are really true, has both invited us, and assisted us to enquire into their causes. Of this we have elsewhere given divers not Medical Instances in our *ESSAY Concerning Improbable Truths*: And I could easily enough, if I durst be tedious, give You some Medical Illustrations of the same Truth. But I dare now only invite you to consider this one thing, which may be of great use to explicate many others, both in Natural Philosophy, and in Physick too, which is, That there are divers Concretes, some of them, as to Sense, *Similar*, or *Homogeneous*, whose differing parts are endow'd with very differing and sometimes contrary Qualities. And this not only appears in the Chymical Analysis of Bodies made by the fire, where the difference of what Chymists call the separated Principles of Concretes, is often very manifest and great, but even in divers Bodies that have not been resolv'd by the violence of the Fire; as is evident in *Rhubarb* taken in substance, whose subtiler parts are purging, and its terrestrial astringent: Nay, if those parts which do in much the lesse quantity concur to the constitution of the Concrete, do but meet with a Body dispos'd to receive their Impressions, it is very possible, that they may work more powerfully on it than the other parts of the same Concrete, of which the Eye judgeth it altogether to consist.

This I have made out to some ingenious Men, by shewing, that though Sallet Oyl be generally reputed to consist of fat and Unctuous Particles, and therefore to be a great resister of Corrosion; yet it contains in it sharp and piercing parts, which meeting with a disposed subject, do more powerfully

*That there are
divers Concretes
as to sense, simi-
lar, whose differ-
ent parts have
contrary Quali-
ties; as Rhubarb
and Oyl-Olive.*

fully operate than the more purely Oleaginous ones. As we endeavoured to evince, by keeping for a short while in a gentle warmth, some pure Oyl-Olive, upon a quantity of Filings of even crude Copper: For from them the Liqueur extracted an high Tincture betwixt Green and Blew, like that which such Filings would have given to distill'd Vineger, which according to Chymists notions obtains that Colour, by making with its Acid and Corrosive Salt a real Solution of some part of the Copper, as may appear by the recoverableness of the Metal out of it. Another proof or two of the Acrimony of some of the parts of Oyl we may elsewhere give you. But now we shall rather confirm our Answer to your Question, by two or three Examples of Cures perform'd by unlikely Remedies.

*Of improbable
Cures, viz. of a
Plurisy by a
Laudanum O-
piatum,*

I went once to visit an Ingenious *Helmontian*, whom I found sick on his Bed, and having by the Symptomes of his Disease discern'd it to be a *Plurisy*, I talkt with him of seasonably opening a Vein, but he was resolv'd against it; and told me he would cure himself by a remedy, which at first seems as likely to increase such a Disease as *Phlebotomy* is to cure it, namely by the use of *Helmonts Laudanum Opiatum*, which in effect did in three or four dayes cure him, and since, he, without Blood-letting, cur'd some others with it, which I the lesse wonder at, because of my having observ'd that *Opium* (with which unskilful men seldom tamper without danger) if duely corrected and prepared, proves sometimes a great Resolver, and commonly a great Sudorifick, insomuch, that I have known it make a person copiously sweat, who often complain'd to me, that other Diaphoreticks had no such operation on him.

I have oftentimes seen Coughs strangely abated by the use of a Remedy, which I have not long since told you how I prepare: and with which (I remember) in a pretty Child you (*Pyrophilus*) know, and who is now very well, I was so happy

as to repress in a few Houres a violent Cough, that threat-
 ned her with speedy Death; and yet this Medicine has so
 eminent a saltness, that the Tongue can scarce suffer it; and
 how much the use of Salt things is by many Physitians con-
 demn'd in Coughs (and indeed in many cases not without
 Reason) I need not tell You. And with exceedingly piercing
 Essence or Spirit of Mans Blood, I have known, norwith-
 standing its being very Saline, and its manifestly heating the
 Patient, especially for the first Four or Five daies, strange
 things perform'd even in a deplorable and hereditary Con-
 sumption. This, *Pyrophilus*, brings into my mind, some-
 thing, that, it may be, you will think odde, which is, that ha-
 ving had occasion to advise for a Person of high quality, with
 a very ancient Gallenist, that in his own Country was look'd
 upon as almost an Oracle, and particularly in reference to
 Phthisical Consumptions, which was there a vulgar Disease;
 He confessed to me, that although his having fallen into it
 himself, made him very solicitous to find a cure for it; and
 though he had in his long and various practise, made trial of
 great variety of Methods and Remedies for the cure of that
 Disease, yet that with which he cur'd himself, and afterwards
 the generality of his chief Patients, was principally *Sulphur*
 melted and mingled in a certain proportion to make it fit to
 be taken, in a Pipe, with beaten Amber or a Cephalick Herb.
 The particular circumstances of his Method I cannot now set
 you down, not having by me the Paper wherein they were
 Noted; but, if I mistake not, the Herb, with which he
 mingl'd the Brimstone of Flower of *Sulphur*, was Coltsfoot
 or Betony; and I well remember, that what he look'd upon
 as the chief and specifick Remedy in his way of curing, was
 the smoak of the *Sulphur*; the other ingredients being added,
 not so much for their being proper enough for the Disease, as
 their helping to fill the pipe, and thereby to allay the pun-
 gency, wherewith the Smoak, if afforded by a Pipe fill'd with

Of Curing
 Coughs and
 Consumptions by
 Saline Medi-
 cines.

Of the Curing
 Phthisical Con-
 sumption by the
 Acid Smoak of
 Sulphur.

Brimstone alone, would be qualify'd. But yet this Sulphureous Smoak is so predominant in the Remedy, that he us'd to have a Syrrup in readines to relieve those, whom the Acrimony of the Fumes should make very sore, and perhaps blister on the one side of their Mouths, or Throats, which accident he provided for, by that cooling and healing Syrrup, without being thereby discourag'd from prosecuting the cure with the same Remedy; wherewith a person very Curious and Rich, has solemnly assur'd me, that himself has cur'd divers Consumptions, and particularly in a Lady, even in health very Lean, that he nam'd to me, as being one I then knew. Now we know that Physitians generally, and in most cases justly, forbid Acid things to those that have exulcerated or tender Lungs, and how highly Acid and piercing the Smoak of *Sulphur* is, the Chymists can best tell you, who, by catching it and condensing it in Glasses shap'd almost like Bells, obtain from it that very corrosive Liquor, which readily dissolves Iron, being the very same that is commonly call'd *Oleum Sulphuris per campanam*, and yet it seems that either the Theory of Consumptions is misunderstood, or that the drying quality of the Sulphureous Steam, and its great power to resist putrefaction, and as it were embalm the Lungs and season the Blood, are considerable enough to account for the Harm which its Acidity may do.

Eeles are so commonly eaten by persons of both Sexes without being taken notice of for any Quality, except their Crudity, that one would scarce believe such a stinking and odious Medicine, as that of their Livers and Galls dried slowly in an Oven, should be more proper for any thing, then to make the taker Vomit; and yet *Helmont* in divers places speaks of the Medicine as if it had kept multitudes of Women from dying of hard Labour. And since him, *Panarola* in his New Observations highly extols it. And I knew a very famous Emperick, who had very few other secrets, and

scarce

The use of
the Livers
and Galls of
Eeles in ex-
pedising the
hard Labour
of Women.

scarce any one so great to get reputation and Money by? And I remember also, That some years since I had occasion to give it to the Wife of a very ingenious Physitian, of whom the Midwives and her Husband almost despair'd, and (as she afterwards told me her self) each Dose made her throwes (which before had left her) return, and at length she was safely delivered, she scarce knew how. But I found double the Dose prescrib'd by *Helmont*, requisite to be used at last; and that the quantity of a Wal-nut of the Powder of these Livers given in Rhenish or White-wine, and when the Stomack was most empty, was no more than such a case required:

Scorpions being Venemous Creatures, to suffocate and infuse them in Oyle, might seem the way to make it Poysonous; if experience did not assure us, that this Oyle is so far from being such, that it Cures the invenom'd bitings of *Scorpions*, which effect, now that the Physitians find it upon tryal to be true, they confesse to be rational, and ascribe it; how justly I now examine not, to the attraction of the Poyson receiv'd into the Body, by that which is outwardly applied to the hurt. And *Piso* informes us that amongst the *Brasilians*, whose Country is so much infested with Venomous Creatures, 'tis the most general Cure to draw out the Poyson by applying to the hurt the Beaten Body of the Beast that gave it. As likewise in *Italy*, they account the crushing of the very *Scorpion*, that has bit a Man, upon the bitten place, for a most speedy and effectual Remedy. And I remember that here in *England* the Old man, whom you have seen going about with *Vipers*, *Toades*. &c, to sell, told me that when he was dangerously bitten by a *Viper* and all swel'd by the Poyson of it; a great part of his cure was the outward application of Venomous Creatures stamp'd 'till they were brought to a Consistence fit for that purpose.

The unlikely
Cave of Ve-
nome by Oyl
of Scorpions

The *Fluxes* are the general and Endemical Diseases in

And of Fluxes
by fresh butter
melted.

Ireland, I need not tell you; and yet I remember, that having occasion to consult the ancientest and most experienc'd Physician of that Nation Dr. F. about the cure of it, he assur'd me, that though during his very long Practice he had found divers Remedies very prosperous, some on one sort of Patients, and some on another; Yet the Medicine he most relyed on, was this. To take unsalted Butter, and boil it gently 'till a pretty part was consum'd; Skimming it diligently from time to time, whilst it stands over the fire; and of this Butter melted, to give now and then a considerable quantity, according as the Patient is able to bear it. A Remedy, which, at the first proposal, may seem more likely to put a man into a Flux, than to cure him of one. And yet the same Remedy, which he suppos'd to benefit by mitigating the sharp humours, and preserving the Entrails from their Corrosion, was afterwards much commended to me by another Ancient *Irish* Physician, who was esteemed among the Doctors the next in Eminency to him that I have named.

C H A P. XIX.

I Should not here, *Pyrophilus*, adde any thing to what I have already said above in favour of the use of even odde Specificks, but, that finding at every turn; that the main thing, which does (really or in pretence) prevail with many Learned Physicians (especially in a famous University You have visited abroad) to reject Specificks, is, That they cannot clearly conceive the distinct manner of the Specificks working; and think it utterly improbable, that such a Medicine which must pass through Digestions in the body, and be whirl'd about with the Mass of Blood to all the parts, should neglecting the rest, shew it self Friendly to the Brain (for instance) or the Kidnies, and fall upon this or that Juice or Humour rather than any other. But to this Objection which I have propos'd as plausible as I can readily make it, I shall at present but briefly offer, according to what has been hitherto discours'd, these two things.

And

And first, I would demand of these objectors a clear and satisfactory, or at least an intelligible explication of the manner of working of divers other Medicaments that do not passe for Specificks; as how *Rhubarb* purges Choler, and *Hellebor* Melancholly rather than other Humours, how some Medicines that have endur'd a strong fire, as *Antimonium Diaphoreticum*, and *Bezoardicum minerale* well made, are yet often times strongly Sudorifick; why the infusion of *Crocum Metallorum* or of Glasse Antimony, though it acquire no pungent, or so much as manifest tast, whereby to veliccate the Palate or the Tongue, are yet violently both Vomitive and Catharrick; And how *Mercury*, which is *innocuously given in many cases* Crude to Women in labour and others, does easily acquire, besides many other more abstruse Medicinal Qualities, not only an Emetick or Purgative, but a Salvating faculty. For I confesse, that to me, even many of the vulgar Operations of common Drugs seem not to have been hitherto intelligibly explain'd by Physitians, who are yet, for ought I have observ'd, to seek for an account of the manner, how Diutericks, how Sudorificks, how Sarcoticks, and how many other familiar sorts of Medicines, which those that consider them slightly are wont to think they understand thoroughly, perform their operations. Nay, I much question, whether the generality of Physitians can yet give us a satisfactory account, why any sort of Medicine purges in general: And he that in particular will shew me, where either the Peripatetick, or Galenical Schools, have intelligibly made out, why *Rhubarb* does particularly purge Choler, and *Senna* more particularly phlegm, *erit mihi magnus Apollo*. For I see not how from those narrow and barren Principles of the four Elements, the four Humours, the four first Qualities (and the like,) Effects, far lesse abstruse than the Operations of Purging Medicines, can satisfactorily be deduc'd. Nor can I find, that any thing makes those Physitians, that are unacquainted

That it is very hard to give an intelligible Explication of the Operation of Emetics and other Common Medicaments which are not Specificks. 280.
281.

quainted with the philosophy that explains things by the Motions, Sizes, and Figures of little Bodies, imagining they understand the account upon which some Medicines are Purgative, others Emetick, &c. And some purgative in some Bodies, Vomitive in other, & both purgative and Vomitive in most, but because they never attentively enquire into it.

But (which is the next thing I have to represent) if we duly make use of those fertile & comprehensive principles of Philosophy, the Motions, Shapes, Magnitudes and Texture of Minute parts of Matter; it will not perhaps be more difficult to shew, at least in general, that Specificks may have such operations, as are by the judicious & experienc'd ascrib'd to them, then it will be for those that acquiesce in the vulgar principles of philosophy and physick, to render the true Reasons of the most obvious and familiar operations of Medicines. And though the same objection that is urg'd to prove, that a Specifick cannot befriend the kidneys, for example, or the Throat rather than any other parts of the Body, lies against the noxiousness of poysons to this or that determinate part; Yet experience manifests that some poysons do respect some particular part of the Body, without equally (if at all sensibly) offending the rest: and we see that *Cantharides* in a certain Dose are noxious to the Kidnies and Bladder, Quicksilver to the Throat, and the glanduls thereabouts, *Stramonium* to the Brain, and *Opium* to the Animal Spirits and *Genus Nervosum*. And if you call to mind, what we have formerly deduced to make it out, That a Humane Body is an Engine, and the Medicines operate in it as finding it so; we need not think it so strange, that there being many Strainers, if I may so call them, of differing Textures, such as the Liver, Spleen, and Kidnies, and perhaps divers local Ferments residing in particular parts, and a Masse of blood continually streaming through all the parts of the body, a Medicine may be quickly, by the blood, carried from any one part to any other

That Poysons
do respect
particular
parts and
therefore Me-
dicines may do
it.

other, and the Blood, or any Humour mingl'd with it, may be as easily carried to the Medicine, in what parts soever it be, and the Remedy thus admitted into the Masse of Blood, may, in its passage through the Strainers, be so alter'd, either by leaving some of its parts there, or by having them alter'd by the abovemention'd Ferments, or by being associated with some other Corpuscles, it may meet within its passage, whereby the Size, or Figure, or Motion of its small parts may be chang'd; or, in a word, it may by some of those many other ways, which might, if this E S S A Y were not too Prolix already, be propos'd and deduc'd, receive so great an Alteration, in reference either to some or other of the Strainers, or other firmer parts of the Body, or to the distemper'd Blood, or some other fluid and peccant matter, that it needs not seem impossible, That by that time the Medicine (crumb'd as it were in Minute Corpuscles) arrives at the *part* or *humour* to be wrought upon, it may have a notable Operation there. I mean *Part as well as Humour*, because the Motion, Size, or Shape of the Medicinal Corpuscles in the Blood, though not by sense distinguishable from the rest of the Liquor they help to compose, may be so conveniently qualify'd, as to shape, bulk, & motion; as to restore the Strainers to their right Tone or Texture, as well as the Blood to its free and Natural course; by resolving and carrying away with them such tenacious matter, as stuff'd or choak'd up the slender passages of the Strainer, or at least straitned its pores, or viciated their Figure; And the same Sanative Corpuscles may perchance be also fitted to stick to, & thereby to strengthen such Fibres of the Strainers, or such other firmer parts of the body, as may need congruous Corpuscles to fill up their little unsupply'd Cavities.

General explanations of the Manner how these Operations of Specifics may proceed.

Meats that are Salt, and Tartareous, whilst they are whirled about in the Mass of blood, may by the other part of that Vital Liquor be so diluted and kept asunder so, as not to be offensive

offensive to any part: When they come to be separated by the *Parenchyma* of the Kidnies, from the sweeter parts of the Blood, that did before temper and allay them; they easily, by their Saline pungency, offend the tender Ureters and Membranous Bladders of those that are troubled with the Stone or Strangurie. And perchance 'tis upon some such account, that *Cantharides* are more noxious to the Bladder than to other parts of the Body. And as Salt meat thus grows peculiarly offensive to the Reines and Bladder; so a Specifick, dispos'd to be dissolv'd, after a peculiar manner, may, in the Body, either preserve or acquire, as to its Minute parts, a friendly congruity to the pores of the Kidnies, Liver, or other Strainers equally, when distemper'd; as I formerly observ'd to You, that New-milk sweetened with Sugar-candy, though it be not wont sensibly to affect any other part of the Body; nor would have sensibly affected the Kidnies themselves, had they not been disorder'd, yet after the troublesome operation of *Cantharides*, it had a very friendly effect upon the distemper'd Parts; Thus a Specifick for one Disease, may be resolved in the Body into Minute particles of such Figure and Motion, that being fit to stick to other Corpuscles of peccant matter, which, by their vehement agitation, or other offensive qualities discompose the Body and make it Feaverish, may allay their vehement Motion, and by altering them, as to bignesse and shape, give them new and innocent qualities, instead of those noxious ones they had before.

Another Specifick may dissolve the Grosse and Slimy Humours that obstruct the narrow passages of the Veines; as I have observ'd that Spirit of Hartshorn, which powerfully opens other obstructions, and resolves stuffing Phlegm in the Lungs; will also, though more slowly, resolve prepar'd Flowers of *sulphur*, crude Copper, and divers other Bodies; and also it may, by mortifying the Acid Spirit that often-

times

times causes Coagulations in the Blood, restore that Vital Liquor to its Fluidity and free Circulation; and thereby remove divers formidable Diseases, which seem to proceed from the Coagulation or Ropiness of the Blood; and on the other side, the minute parts of some Specificks against a contrary Disease, may somewhat thicken and fix the too thin and agitated parts of the Blood, or of some peccant matter in it, by associating themselves therewith: as the nimble parts of pure Spirits of Wine, and those of high rectified Spirit of Urine, will concoagulate into Corpuscles, bigger and far less Agile. And the same Spirit of Wine it self, with another Liquor I make, will presently concoagulate into a kind of soft, but not fluid Substance. Nor is it so hard to conceive, that a Specifick may work upon a determinat part or Humour, and let the others alone: as if you put, for Instance, an Egg into strong Vineger, the Liquor will operate upon, and dissolve all the hard shell, and yet leave the tender skin untouch'd. And if you cast Coral into the common rectify'd Spirit of Tartar, the far greater part of the Liquor, though strong and spirituous, will remain unalter'd thereby, and may be, *integris viribus*, abstracted from it; but the Coral will presently find out, or rather be found out by Acid or Acetuous particles, and by incorporating it self with them, take away their sharpnes: as in some cases Coral has been observ'd to do to sower Humours abounding in Humane Bodies, those Humours being easily, by the Circulating Blood, brought (in their passage) to the Coral, whilst it perhaps remains in the Stomach or Guts. And though the circulation of the Blood be sufficient to bring, little by little, the Acid particles of that Liquor in its passages through the vessels to work upon Coral; yet in other Medicines the Operation may be more nimble: The Remedy quickly diffusing it self through the Mass of Blood, to seek, as it were, and destroy the Acid parts, which it meets with blended with

That Vineger will operate on the shell, and not upon the other parts of the Egg, with like Instances of Specificks operations.

the rest of the Liquor, as Spirit of Urine being, instead of Coral put into the above mention'd Spirit of Tartar, will not (that I have observ'd) fasten it self to the Spirituous nor the Phlegmatick parts of the Liquor, but onely to the Acid ones, which it will Mortifie or deprive of their Sowernes by concoagulating with them. And I see not why it should be more inconceivable that a Specifick should have a peculiar Virtue to free the Body from this or that peccant Humour, and a benign congruity to the distemper'd Spleen or Liver, than that some Cathartick should purge Electively, and some Antidotes have peculiar Vertues against such Poysons, whose Malignity particularly invades the Brain or Kidneys, or some other determinat part: the former of which the Physicians, we reason with, scruple not to teach, and the later of which is taught us not by them onely, but by Experience too.

[Of the credibility of Specificks, and of the Efficacy even of some unlikely ones, we might easily enough present you with more Proofs and Examples: But these may possibly be sufficient for our present purpose, especially if you duely consider, That as Physick had ow'd its beginning to Experience, so those that practise it must enlarge and rectifie their principles according to the new discoveries, which are made from time to time of the Operations and Power of the productions whether of Nature or of Art. This consideration I thought to insist upon in my own Expressions; but finding lately the same Notion which I had, to have been long since that of the ancient Empericks, I will summe up what I meant to say, in their words, as I find them wittily deliver'd by *Celsus*, in that excellent Preface, where having spoken in their Sense of the Origin of Physick, he continues, *Sic Medicinam ortam, subinde aliorum salute aliorum interitu perniciofa discernentem à salutaribus: Repertis deinde Medicinae remediis, homines de rationibus eorum discernere cœpisse, nec post*

Rationem

That Physick, as it began by Experience, so it must be enlarg'd and rectify'd by the new discoveries of Experience.

Rationem, Medicinam esse inventam, sed post inventam Medicinam, Rationem esse quasitam. And least the mistaken name of Emperick should make you undervalue so useful a Consideration, which not the nature of their Sect, but that of the thing, suggested to them; I shall adde in favour of what we have deliver'd concerning experienced, though otherwise unlikely Remedies, that tis a sentence ascrib'd to *Aristotle* (and, in my Opinion, one of the best that is ascrib'd to him) *Ubi res constat, si opinio adversetur rei, quarendam rationem non rem ignorandam.*]

And certainly, *Pyrophilus*, though there be scarce any sort of men, whose credulity may do the World more mischief than that of Physicians; yet perhaps, neither Nature nor mankind is much beholden to those, that too rigidly, or narrowly, circumscribe, or confine the operations of Nature, and not so much as allow themselves or others to try whether it be possible for *Nature*, excited and mannag'd by *Art*, to perform divers things which *they* never yet saw done, or work by divers ways, differing from any, which by the common principles that are taught in the Schools, they are able to give a satisfactory account of.

To the many things which you may be pleased to apply to this purpose out of the precedent Discourse, divers others may be added, if without tiring you, they may be now insisted on. It would scarce have been believed some Ages since, by those that knew no other then Vegetable Purges and Vomits, that a Cup made of a Concreate, insuperable by the heat of Humane Stomachs, should, by having for a while Wine, or any such other Liquor, barely pour'd on it, to make an Infusion, without any sensible Diminution of its own bulk or weight, and without any sensible alteration made in the Colour, Taste, or Smell of the Wine, communicate to it a strongly Emetick and Cathartick Virtue, and prove oftentimes Vomitive, ev'n when put up in the Clysters; & yet that

That the Operations of the Antimonial Cup, Glass of Antimony, and Crocus Metallorum would not have been credited in Ancient times.

this is performable by Antimony, slightly prepared with Salt-Peter, or without addition, melted into a Transparent Glass, is commonly known to those that are not Strangers to the Operations of the Antimonial Cup, and of the Glass made of the same Mineral. And much more strange is that which is affirmed by inquisitive Physicians upon their own Trial of the common *Crocus Metallorum*, or somewhat corrected Antimony wont to be sold in Shops, namely, That a few Drachmes of it, infus'd into some Ounces of Wine, will make the Liquor work so strongly, as if fix or eight times the quantity had been steep'd in it.

Those that believe that all Diaphoreticks must consist of subtle, sapid, and fugitive parts, as if onely such were easily separated from each other, and agitated by the gentle heat of a Humane body, will scarce expect that any body could, in a moderate Dose, be a good Sudorifick, that is so fixt as to be able to persist dives hours in a good Fire. And yet that *Antimonium Diaphoreticum* is such a Concrete, is now very well known to many besides Chymists.

Divers other instances alike incredible.

That a Stone, and a Stone too so fixed, that it will sustain the violence of reverberated Fire, and is consequently very unlikely to be much wrought upon, or digested by the heat of a Humane Stomach, should be capable of agglutinating together the parts of broken bones, would seem impossible to many, but tis very well known to those that have made tryal of the efficacy of the *Lapis Ossifragus*: for though I have sometimes wondred at the Fixednes of this Stone above others in the Fire, yet being for some dayes successively drunk in Wine, or *Aqua Symphyti*, to the quantity of about half a Drachme, or more, it doth so wonderfully cement together the parts of broken and well set Bones, that it deserves the name it commonly hath in the Shops of *Osteocolla*, and hath wonders related of it by several eminent, not onely Chymical, but *Galenical* Writers.

Tis almost incredible what *Quercetane* relates of what himself saw done with it as to the cure of broken Bones, without much pain, or any of the usual grievous Symptoms, within four or five dayes; so that to the stupendous Virtue he ascribes to this Stone, both inwardly given, and outwardly applied in the form of a Pultis, with onely beaten *Geranium* and Oyl of Roses or Olives, he thinks fit to annex these words: *Quod incredibile videri posset, nisi prater me innumerabiles alii oculati & idonei testes extarent.* And indeed these need good proof to make a Wary man believe so strange a thing, since Chirurgeons observe, That Nature is wont to be fourty dayes in producing a *Callus* to fasten together the pieces of a broken Bone. But to make this the more credible by the testimony of Authors more *Gallenically* inclin'd, *Matthiolus* relates, That in many the Bones having been very well set (which Circumstance he requires as necessary) have had their broken parts conglutinated within three or four days. And not only that most experienced Chirurgeon *Fabricius Hildanus* us'd it much in Fractures, with only a little Cinnamon and Sugar to make it pleasant; but the learned *Sennertus*, who somewhere calls its virtue admirable, thinks it requisite in his Chirurgery, to give us this caution of it: *Verum in juvenibus, & iis qui boni sunt habitus, callum nimis auget, Quapropter cautè & non nisi in adultioribus exhibendus:* The warrantableness of which caution, and consequently the strange efficacy of *Osteocolla*, was, I remember, confirm'd to me not long since by a skilful Physician, who hath particularly studied its nature, and related to me, That some years since his Mother, having by a fall broken her Leg near the Knee, had too suddenly, by the overmuch use of this Stone, a *Callus* produced in the part much bigger than he expected or desired.

He that, before the Salivating property of *Mercury* was discovered, should have told Physicians of the despondent temper

Fab. Cent. 3.
Obser. 90.

Lib. 5. part. 5.
Cap. 1.

temper of these, we are now discoursing with, that besides the known ways of disburthening Nature, (namely by Vomit, Siege, Urine, Sweat, and insensible Transpiration) there were a sort of Remedies, that would make very large Evacuations by Spittle, and thereby cure divers stubborn Disease, that had been found refractory to all ordinary Remedies, would certainly have been more likely to be derided than believed by them; since no known Remedy, besides *Mercury*, hath been, that I remember, observed to work regularly by Salivation: for though *Ceruss* of *Antimony* have been observed to make men, of some Constitutions, apt to spit much, yet it works that way too languidly, to deserve the name of a Salivating Remedy, and probably oweth the quality it hath of inclining to Spit, to the *Mercurial* part of the *Antimonic*, wherewith the *Regulus* it is made of abounds) and therefore the greater their Experience of the Effects of Medicinal Operations should be supposed to be, the greater indisposition it would give them to credit so unalloyed a Truth. And yet the reality of the Fluxing Property of Quick-silver is long since grown past question, and hath been found so useful in the cure of the most radicated and obstinate Venereal Distempers, that I somewhat wonder those Physicians, that scruple not to employ as boisterous ways of Cure, have not yet applied it to the extirpation of some other diseases, as Ulcers of the Kidneys, Consumptions, and even Palsies, &c. wherein I am apt to think it may be as effectual as in those produced by Lust, and much more effectual than vulgar Remedies, provided that the exceeding troublesome way of working of salivating Medicines be better corrected, than it is wont to be in the ordinary Medicines employed to produce Salivation, which they do with such tormenting Symptomes, that they are scarcely supportable. But if purified Quick-silver be dexterously precipitated by a long and competent Digestion, with a due proportion of
refined

refined Gold, Experience hath informed us, that the salivating operation of it may be performed with much less uneasiness to the Patient: And that such *Mercurial* Medicines, wherein the Quick-silver is well corrected by Gold, may produce more than ordinary effects, we have been inclined to believe, by the tryals which we procured by Learned Physicians to be made in other than Venereal Diseases, of a gently working precipitate of Gold and *Mercury*, of which we may elsewhere set you down the process.

[And now I am upon the Discourse of the peculiar Operations of *Mercury*, and of unusual wayes of Evacuation, I am temptred to subjoyn an odde Story, which may afford notable Hints to a speculative Man, as it was related to me both in private, and before Illustrious Witnesses, by the formerly commended Chymist of the *French King*: He told me then a while since, that there is yet living a person of Quality, by name *Monsieur de Vatteville*, well known by the Command he hath or had of a Regiment of *Switzers* in *France*, who, many Years agoe following the Wars in the *Low Countries*, fell into a violent Distemper of his Eyes, which, in spight of what Physicians and Chyrurgians could doe, did in a few Months so increase, that he lost the use of both his Eyes, and languish'd long in a confirm'd Blindness; which continued till he heard of a certain Emperick at *Amsterdam*, commonly known by the name of *Adrian Glas-maker* (for indeed he was a Glasier) who being cry'd up for prodigious Cures he had done with a certain Powder, this Colonel resorted to him, and the Emperick having discours'd with him, undertook his recovery, if he would undergo the torment of the Cure, which the Colonel having undertaken to do, the Chyrurgion made him snuff up into each Nostril about a Grain of a certain *Mercurial* Powder, which in a strangely violent manner quickly wrought with him almost all imaginable waies, as by Vomit, Siege, Sweat, Urine,

*A strange Cure
of Blindnes by a
Mercurial Powder.*

rine, Spitting, and Tears, within ten or twelve Hours that this Operation lasted, making his Head also to swell very much: but within three or four dayes after this single taking of the Drastick Medicine had done working, he began to recover some degree of Sight, and within a Fortnight attained to such a one, that he himself assur'd the Relater, he never was so sharp-sighted before his Blindness. And the Relater assur'd me, that he had taken pleasure to observe, That this Gentleman, who is his familiar Acquaintance, would discern Objects farther and clearer than most other men. He added; That *Monsieur de Vatteville* told the Relater, he had purchas'd the way of making this powder of the Emperick, and had given it to an eminent Chirurgeon, one *Benoest* (an Acquaintance of the Relaters) by whom he had been cured of a Musket-shot, that had broken his Thigh-bone, when the other Chirurgions would have proceeded to Amputation; and that this *Benoest* had with this Powder administred, as before is related, cur'd a Gentlewoman of a *Cancer* in the Brest. All which, and more, was confirm'd to the Relater by the Chirurgeon himself. But in what other stubborn and deplorable cases they use this Powder, I do not particularly remember. The Preparation of it, which a Chymist did me the favour to tell me by word of mouth, as a thing himself had also made, was in short this: That the Remedy was made by precipitating Quick-silver with good Oyl of Vitriol, and so making a *Turbith*, which is afterwards to be dulcified by abstracting twenty or twenty five times from it pure Spirit of Wine, of which fresh must be taken at every Abstraction. But I would not advise you to recommend so furious a powder to any, that is not a very skilful Chymist and Physician too, till you know the exact preparation, and particular uses of it; the reason of my mentioning it here, being but that which I expressed at the entrance upon this Narrative.]

CHAP. XX.

You will perchance wonder, *Pyrophylus*, that having had
 so fair an opportunity as the subject of his Essay afford-
 ed me, of discoursing to you about the Universal Medicine, *Of universal*
 which many *Paracelsians*, *Helmontians*, and other Chymists *Medicines.*
 talk of so confidently : I have said nothing concerning the
 existence, or so much as the possibility of it. But till I be
 better satisfied about those Particulars than yet I have been,
 I am unwilling either to seem to believe what I am not yet
 convinced of, or to assert any thing, that may tend to dis-
 courage Humane Industry; and therefore I shall only ven-
 ture to adde on this occasion, That I fear we doe somewhat
 too much confine our hopes, when we think, that one ge-
 neros Remedy can scarce be effectual in several Diseases, if
 their causes be supposed to be a little differing. For the *Theo-*
ry of Diseases is not, I fear, so accurate and certain as to
 make it fit for us to neglect the manifest or hopeful Vertues
 of noble Remedies, where ever we cannot reconcile them to
 that *Theory*. He that considers what not unfrequently hap-
 pens in distempered Bodies by the *Metastasis* of the Morbi-
 fique matter (as for instance, how that which in the Lungs
 caused a violent cough removed up to the head may pro-
 duce (as we have observed) a quick decay of Memory and
 Ratiocination, and a Palsie in the Hands and other Limbs)
 may enough discern that diseases that appear very differing
 may easily be produced by a peccant matter of the same na-
 ture only variously determined in its operations by the con-
 stitution of the parts of the body where it setleth: and conse-
 quently it may seem probable to him, that the same learch-
 ing Medicine being endowed with qualities destructive to the
 texture of the Morbifique matter, where ever it finds it, may
 be able to cure either all, or the greatest part, of the Disease

*That the same
 Matter may
 cause divers
 Diseases.*

which the various translation of such a matter hath been observed to beget. Moreover, it oftentimes happens that Diseases, that seem of a contrary nature, may proceed from the same cause variously circumstantiated; or (if you please) that of divers Diseases, that may both seem primary, the one is but Symptomatical or at most Secondary in relation to the other; as a Dropsy and a slow Feaver may, to unskilful men, seem Diseases of a quite contrary nature, (the one being reputed a hot and dry, the other a cold and moist Distemper) though expert physicians know they may both proceed from the same Cause, and be cured by the same Remedy. And in women experience manifests, that a great variety of differing Distempers, which by unskilful physicians have been adjudged distinct and primary Diseases, and have been, as such, unsuccessfully dealt with by them, may really be but disguised Symptoms of the distempers of the Mother or *Genus Nervosum*; and may, by remedies reputed *Antipyretical*, be happily remov'd. To which purpose I might tell you, *Pyrophilus*, That I, not long since, knew a practitioner, that with great success us'd the same remedies (which were chiefly Volatile and Resolving Salts) in Dropsies, and in (not, Symptomatical, but) Essential Feavers. And our selves have lately made some Experiments of not much unlike nature, with a preparation of Harts-horn, of equal use in Feavers and Coughs, both of them primary. I might on this occasion recur to divers of the Remedies formerly mention'd in several places of this Essay, since divers of them have been found effectual against Diseases, which, according to our common Theory, seem to be little of kin one to another: And by telling you what I have observed concerning the various operations of *Helmont's Laudanum*, of our *ens Veneris*, and even of a Medicine devised by a Woman, the Lady *Kents* powder, I might illustrate what I have lately delivered: But it is high time for me to pass on to another subject, and

And the same
Medicine cure
them.

and therefore I shall rather desire you, in generall, to consider, whether or no severall differing Diseases, and even some commonly supposed to be of contrary natures, be not yearly cured by the *Spaa-waters* in *Germany*.

And to assist you in this enquiry, I shall addresse you to the rare observations of the famous & experienced *Henricus ab Heer*, and to his *Spadacrene*; in the eighth Chapter of which he reckons among the Diseases which those Waters cure, Catarrhs, & the Distempers, which (according to him) spring from thence; as the Palsie, Trembling of the Joints, and other Diseases of kin to these, Convulsions, *Cephalalgia*, (I name them in the order, where I find them set downe) *Hemicrania*, *Vertigo*. rednesse of the Eyes, of the Face, the *Erysipelata*, *Ructus continui*, *Vomitus*, *Singultus*, Obstructions, and even Scyrhus's, if not inveterate, of the Liver and Spleen, and the Diseases springing thence; the Yellow Jaundise, *Melancholia flatulenta seu Hypochondriaca*, Dropies, Gravell, Ulcers of the Kidneies, and *Caruncula in meatu urinario* (*Gonorrhæas*, and resembling affections, *Elephantiasis* or the Leprosie, *fluor albus mulicrum*, Cancers and Scyrhus's of the Womb, Fluxes and even Dysenteries; the Worms (though very obstinate, and sometimes so copious as to be voided in his presence, even with the Urine) Sterility, and not only the *Scabies* in the Body and Neck of the Bladder, and clammy pituitous Matter collected therein besides Ulcers in the *Sphincter* of it; but he relates, upon the repeated Testimony of an eminent person that he names, and one whom he styles *Vir omni fide dignissimus*, That this party being troubled with a very great Stone in his Bladder, and having had it search'd by divers *Lythotomists*, before he came to the *Spaa*, did, by very copiously drinking these Waters, find, by a second search made by those Artists, that his Stone was much diminished the first Year, and (by the same way of tryall) that it was so the second Year. And

An Instance in
the waters of
the Spaa.

of the Cures of these Diseases, the Physitian mentions in the same Chapter, as to many of them, particular and remarkable Instances; and in the beginning of the next Chapter, having told his Readers that he expects they should scarce believe these Waters can have such a variety of Vertues, *Ceterum, saies he, si in Spaa maturè & constantibus naturalibus, vitalibusq; facultatibus venerint; aqua q; quo dicemus modo bibarint, indubiè quæ dixi vera esse fatebuntur:* And though we be not bound to believe (nor doth he affirme it) that the Spaa-waters do *universally* cure all the afore-mentioned distempers; yet it is very much, and makes much for our present purpose, that they should in so many patients cure most of these distempers, and lessen, if not cure, the rest. And we may somewhat the better credit him, because even where he reckons us the Vertues of the Spaa, he denies it some, which other Physitians ascribe to it. And it is very considerable, what he subjoynes in these words: *Pau- cissimos enim vel nullos Spada Incolas Capitis doloribus, Cardialgiâ, Calculo, Obstructionibus renum, Hepatis, Lienis, Mesaraicarum, laborantes invenies; Ictericos, Hydropicos, Podagricos, Scabiosos, Epilepticos, quod sciam, nullos.* But that which I most desire you to take notice of, is, That besides all the above mentioned Diseases, I find that he ascribes to these Waters the Vertues of curing such as are counted of a contrary nature, & are thought to require contrary Remedies. For besides that, he expressly affirms, in the beginning of the eighth Chapter, That these Waters being endow'd with the Vertues both of hot and cold Minerals, they cure both hot and cold affections, in the same Patients, and in differing Bodies, and that contrary Effects are performed by them: He hath, after some Pages, this Passage, which may go for an Illustrious proof of that he hath asserted: *Inter cetera*) (saith he, speaking of the Spaa-Waters) *Mensibus movendis imprimis idonea, quod millies experientia comprobavit.*

comprobavit. Et tamen nimium eorum fluxum quovis alio medicamento fecilius sistit.

These Testimonies, *Pyrophylus*, of our experienced Author would perhaps obtain the more credit with You, if You had seen what I lately had the opportunity to observe in a hot and dry Season, at our own *Tunbridge-Waters* in *Kent*, when I was there to drink them. And therefore I shall again invite You not onely to consider, Whether one potent Remedy, such as it may be, may not be able to cure variety of Diseases, and some suppos'd to be of contrary natures; But whether or no divers Persons, on whom the received *Methodus medendi* hath been long and fruitlessly employ'd, be not by their tyred and despondent Physicians themselves sent thither, and there cur'd of their abstruse and obstinate Diseases by Remedies prepar'd by Nature without the assistance of, Art; For if you duly reflect on this conspicuous Observation, and consider how much it is possible for Art to meliorate and improve most (especially Mineral) Remedies, afforded us by Nature, you would probably dare to hope, That Medicines might be prepared of greater Efficacy, and applicable to more diseases, than they who think the more received Theory of Diseases (from which yet very eminent Physicians, in divers Particulars, scruple not to recede) incapable of being re-*ctified*; and that judge of all Remedies by them, that are publick'y Vend in Apothecaries Shops, will allow themselves so much as to hope.

If now you demand, *Pyrophylus*, if I thinke that every Particular which hath contributed to swell this Discourse into a bulk so disproportionate to that which the Title of an Essay promised, to directly belong to the Art of Physick? I shall leave it to the Judicious *Celsus* (whom Learned Men have stiled *The Roman Hippocrates*) to answer for me, and he will tell you, That *Quaquam multa sint ad ipsas artes non pertinentia, tamen eas adjuvant excitando artificis ingenium.*

Of the reason and designe of the Authors Discourse concerning the Methodus medendi, and his descending to other particulars which may be thought improper for Him.

I suppose I need not remind You, *Pyrophylus*, that it was not my design, in what hath been represented, to subvert those principles of the *Methodus medendi*, from which no sober Physicians themselves recede, and in which they unanimously acquiesce: And that I much lesse intend to countenance those venturous Empericks, who, without any competent knowledge of Anatomy, Botanicks, and the History of Diseases, thinke Receipts or processes alone can enable them to cure the Sickneses they know not, and who would perswade men to lay by, as needless, a profession, of whose Usefulnessse to Mankind we may elsewhere have occasion to discourse. No, *Pyrophylus*, without peremptorily asserting any thing, I have but barely represented the Notions I have mention'd concerning the *Methodus medendi*, as things probable enough to deserve to be impartially considered; That in case they prove fit to be declin'd, they may appear to have been rejected not by our superciliousnesse or lazinesse but (after a fair tryall) by our experience: And in case they seem fit to be approved, they may prove additional Instances of the Usefulnessse of *Natural Philosophy* to Physick. Which Usefulnessse, *Pyrophylus*, if I have in any considerable measure been so happy as to make out, I shall not thinke the time (and much lesse the pains) I have bestow'd upon that Theme, mispent. For, I must confesse to you, *Pyrophylus*, that to me it seems, that few things ought more to endear to us the Study of *Natural Philosophy*, than that (according to the judicious Sentence of our *Celsus*, *Rerum Natura contemplatio*, saith he, *quamvis non faciat Medicum, aptiorem tamen Medicinam reddit*) a deeper insight into Nature may enable Men to apply the Physiological Discoveries made by it (though some more immediately, and some lesse directly) to the Advancement and Improvement of Physick.

And I well enough know, *Pyrophylus*, that instead of Writing the Essay to such a one as You, I should Write it

to the more criticall and severer sort of Readers, they would be apt to think both that it is impertinent for me, who do not profess to be a Physician, to treat prolixly of Matters Medicinal; and that it may appeare somewhat below me, in a Booke, whose Title seems to promise you Philosophicall Matters, to insert I know not how many Receipts: But I shall not scruple to tell such a Person as *Pyrophylus*, That since my Method requir'd that I should say something to you of the *Therapeutical* part of Physick, I thought that Christianity & Humanity it self, oblig'd me not to conceal those things, which how despicable soever they may seem to a speculative Philosopher, are yet such, as, besides that *some* of them may perhaps afford improvable Hints touching the Nature of Remedies, if not also of Diseases, Experience hath encouraged me to hope, that *others* may prove useful to the sick. And as for the inserting of Receipts, even in Books of Philosophical Subjects, I have not done it altogether without example. For not only *Pliny*, a Person of a great Dignity as well as Parts, and Friend to one of the greatest *Roman* Emperors, hath left us in a Book, where he handles many Philosophical Matters, store of particular Receipts; but our Chancellour, The Lord *Verulam*, hath not disdain'd to Record some. And as for that Industrious Benefactor to Experimental Knowledge, the Learned and pious *Mersennus*, his Charity made him much more fearful to neglect the doing what good he could to others, than to venture to lessen his Reputation by an *Indecorum*, that in a Mathematical Book, and in a Chapter of Arithmetical Combinations, he brings in not only a Remedy against the *Erysipelas*, but even in a Medicine for Cornes, where he tels us, That they may be taken away, by applying & daily renewing for ten daies, or a fortnight, the middle stalke that grows between the Blade & the Root (for that I suppose he means by the unusuall Word *Thallum*) of Garlick, bruised. Nor is
it

it without Examples ; though somewhat contrary to my Custom in my other Writings , that in this , and the four precedent Essays, I have frequently enough alleadged the Testimonies of others , and divers times set down Procellis or receipts, not of my own devising. For even among professed and learned Physitians, scarce any thing is more common , than on Subjects far less of kin to Paradoxes, than most of those I have been discoursing of, to make use of the Testimonies and Observations of other approved Writers, to confirm what they teach. And not now to mention the voluminous Books of *Schenkius* the *Scolzius*, that famous and experienc'd Practitioner *Riverius* himself, hath not been ashamed to publish together a good number of Receipts, given him by others, under the very Title of *Observationes communicatae* : And *Henricus ab heer*, hath, among his *observationes oppido rarae*, divers Receipts that came from Mountebanks, and even Gypsies. And therefore I hope that you, who know that it is not after every Body that I would so much as relate an Observation, or mention a Medicine, as thinking them probable, will easily excuse one that hath much fewer Opportunities than a profess'd Physician to try Remedies himselfe; if treating of Subjects not so familiar, I choose to countenance what I deliver by the Testimonies of skilful Men, and if I scruple not to preserve in these Papers some not despicable Remedies, as well of abler Men as of my own, that otherwise would probably be lost; But of this Practise I may elsewhere have occasion to give you a more full Apology, by shewing how much it may conduce to the enriching and advancement of Physick; an Art, with those praises I could long entertain You, if I were at leisure (and durst allow my selfe) to exhaust common places.

And yet give me leave to tell you, That man is so noble a Creature, and his health so requisite to his being able to relish other goods; and oftentimes also to the comfortable performance

performance of what his Conscience, his Countrey, his Family, his Necessities, and perhaps his allowable Curiosity challenge from him, that I wonder not so much at those Ancient Heathens, that being Polytheists and Idolaters, thought themselves oblig'd, either to refer so useful an Art, as that of Physick, to the Gods, or God-like persons; or to adde those that excell'd in so noble a Faculty, to the number of those they worship'd. For my part, *Pyrophilus*, a very tender and sickly Constitution of my own (much impair'd by such unhappy Accidents as Falls, Bruises, &c.) hath, besides (as I hope) better motives of Compassion, given me so great a sense of the uneasinesses that are wont to attend Sicknesse, that I confesse, if I study Chymistrie, tis very much out of hope that it may be usefully imploy'd against stubborn Diseases, and relieve some languishing Patients with less pain & trouble, than otherwise they are like to undergoe for Recovery. And really, *Pyrophilus*, unlesse we will too grossly flatter ourselves, we can scarce avoid both discerning and deploring the ineffectualnes of our vulgar Medicines, not onely *Galenical*, but Chymical; for an active Body may yet be but a languid Remedy.) For besides that many that recover upon the use of them, endure more for Health, than many that are justly reckon'd among Martyrs did for Religion. Besides this, I say, we daily meet with but too many in the case of that bleeding Woman, mentioned in the Gospel, of whom tis said, That she had suffer'd many things of many Physitians, and had spent all that she had, and was nothing better'd, but rather grew worse. And therefore I reckon the investigation and divulging of useful Truths in Physick, and the discovering and recommending of good Remedies among the greatest and most extensive acts of Charity, and such, as by which a Man may really more oblige Man-kind, and relieve more distressed Persons, than if he built an Hospiral. Which perhaps you will not think rashly said, if you please but to con-

Mark. 5. 26.

sider, how many the knowledg of the Salivating, and other active properties of *Mercury*, and of its enmity to putrefaction and Distempers springing thence, have cur'd of several Diseases, and consequently how many more Patients, than have recover'd in the greatest Hospital in the world, are oblig'd to *Carpus*, and those others, who ever they were, that were the first discoverers of the medical efficacy of *Quicksilver*. And for my own particular, *Pyroph*: though my Youth and Condition forbid me the practice of Physick, & though my unhappy Constitution of Body kept divers Remedies from doing me the same good they are wont to do others; yet having more than once prepar'd, and sometimes occasionally had opportunity to administer Medicines, which God hath been so far pleas'd to bless on others, as to make them relieve several Patients, and seem (at least) to have snatcht some of them almost out of the jaws of death; I esteem my self by those successes alone sufficiently recompenc'd for any toil and charge my Enquiries into Nature may have cost me. And though I ignore not, that tis a much more fashionable and celebrated practice in young Gentlemen, to kill men, than to cure them; and that mistaken Mortals think it the noblest Exercise of virtue to destroy the noblest Workmanship of Nature, (and indeed in some few cases the requisiteness and danger of *destructive valour* may make its Actions become a vertuous Patriot) yet when I consider the Character given of our great Master and Exemplar, in that Scripture, which saies, *that he went about doing Good, and Healing all manner of Sicknes, and all manner of Diseases among the people*, I cannot but think such an employment worthy of the very noblest of his Disciples. And I confess, that if it were allow'd me to envy creatures so much above us as are the Celestial Spirits, I should much more envy that welcome Angels charitable employment, who at set times diffus'd a healing virtue through the troubled waters of *Bethesda*, than that

That this Employment is better than the more fashionable of destroying *Valour*.

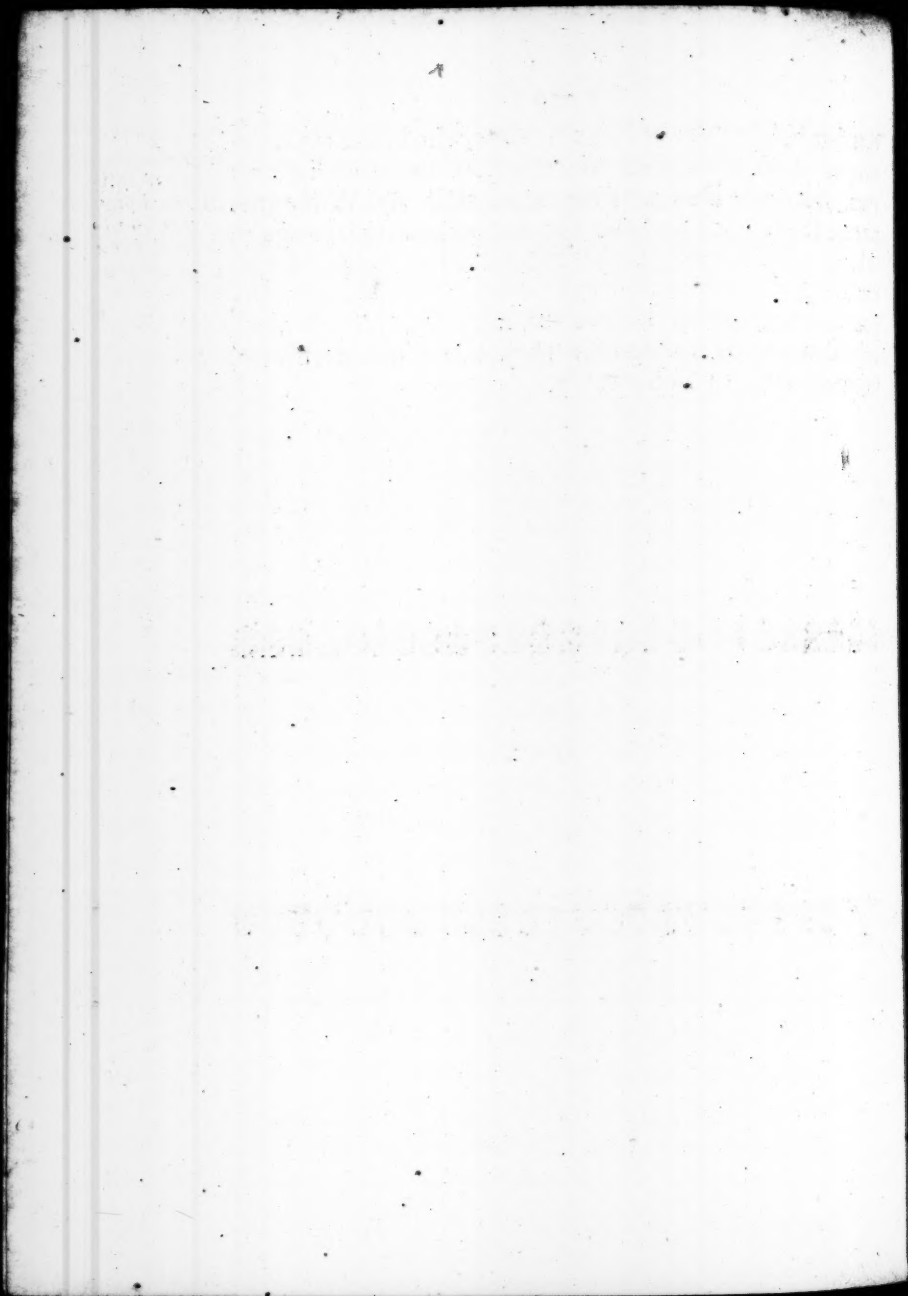
Acts 10. 38.
Mat. 4. 24.

John 5. 14.
2 Kings 19. 35.

that dreadful Angel's fatal imployment, who in one night destroyed above a hundred and fourscore thousand fighting men. But of the Desirableness of the skill, and Willingness to cure the sick, and relieve not onely those that languish in Hospitals, but those that are rich enough to build them, having elsewhere purposely discoursed, I must now trouble you no longer on this Theme, but implore your much needed pardon, for my having been (beyond my first intentions) so troublesome to You already,

The Angels charitable employment at Bethesda more desirable than his who destroyed in one night 180000 fighting men.





AN
APPENDIX

TO THE
FIRST SECTION
OF THE

Second Part.

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Advertisements touching the following
APPENDIX.

I Scarce doubt, but it will be expected that I should annex to the foregoing Treatise those Receipts and Processes, which seem to be here and there promis'd in it; But I desire it may be considered, that some passages, which an unattentive Reader may have mistaken for absolute Promises, are indeed but Profers conditionally made to a particular person; and so not engaging me, till the condition (which was his desiring the thing mention'd to him) be on his part performed. And as for the other things, which every Reader may suppose to be promis'd him, I have at hand this general excuse; that at least I promis'd nothing to the Publick, whatever promises I may have made in the foregoing ESSAYES, having together with them been address'd to a private Friend. And I have two or three special Reasons to insist on this Excuse; for divers of my choicer Books and Papers having not long since unhappily miscarried through the Negligence of some Men, and Fraud of others, it is not now possible for me to retrieve some of the things I was Master of, when I promised them. And then to revise carefully all the Papers that remain in my hands of affinity with the past Treatises, would take up more time than is allow'd me by other Studies and Employments, which I think of greater moment, or at least wherein I am much more concern'd, than to give this Book at present a full or accurate APPENDIX.

But though I might upon these and other Reasons wholly excuse my self from the trouble of adding any Appendix, yet
because

because the communicating of good Medicines, is a work of Charity, and those unpolisht and immethodical Notes that may perchance disparage an Author, may yet relieve many a Patient; I am willing to do what my occasion will permit; and finding among my papers many loose Sheets, concerning Spirit of Harts-horn, Blood, &c. written divers years since to a Friend, I choose rather to publish them just as I find them with *Pyrophilus's* name, employed in convenient places, and to adde some unpromised Receipts in stead of those that are lost, than be altogether wanting, to what may be expected from me. I know that what I deliver concerning some of the following Preparations, may by severer Criticks be thought somewhat unaccurate, and I confess I am of that mind my self; But meeting with these Collections in loose Sheets among my old papers, I must either publish them as I find them, or take the pains to polish and contract them, which would require more time, than I can at present afford them. And much lesse can I stay to subjoyn the Histories of the particular cures perform'd by the Medicines, whose preparations I set down, though divers of them would not perhaps appear inconsiderable. But if I find by the entertainment of these papers, that it will be worth while to revise or enlarge them, I may, God permitting, be invited to do it, and either supply the things that are here deficient, out of After-observations, or Papers now out of the way, or make amends for their omission in substituting better things.

It will not at all surprize me if some Readers think me too prolix in delivering the preparations of Harts-horn, *Ens Veneris* &c. with such particular and circumstantial Observations. But my design being to gratifie and assist those that would make and use the Remedies I recommend, the Experience I have had of the difficulties most men find in the preparing things by the Direction of Chymical Processes not very expressly set down, makes me apt to hope, that

that (I say not the great Physicians or Chymists, who may, if they please, leave them unperus'd; but) those for whom I principally intend my Directions will think my having made them so particular a very excusable fault, And I make the lesse difficulty to suffer such things, as perhaps, I judge to be, in comparison of others, but trifles, to pass abroad, because finding of late years, that many persons of quality of either Sex, who scarce read any other then English Books, have (as I hope) out of Charity, or Curiosity, or both, begun to addict themselves to Chymistry, and venture to be tampering with Spagirical Remedies, it may not be unseasonable to supply them with some Preparations that may both save them time and Charges, and put them upon the use of Remedies, which, without being languid, are, if any thing discreetly given, safe and innocent, and wherein a little Error either in the making or the administering will be far lesse prejudicial to the sick, then if it were committed in the more vulgar (oftentimes, either falsely or obscurely prescrib'd) preparations they are wont to make of Acid Salts, Mercury, Antimony, and other Minerals, whose Activity for the most part make them need to be skilfully prepar'd and judiciously given.

The Irish Lithotomists Receipt, for the Stone in the Bladder.

REc. *Aquar. Melon, Citrullor, Filipendula, Petroselin, syr. de 5 radicibus, syr. de B santiis, ana, unc. ij. Oxy melit comp, unc. j. misce, quartam mixti partem sumas mane jejuno, & postea per octo horas à cibo & potu abstineas, aliam sumam partem eodem die post cœnam cum lectum intrare volueris, deniq; sequenti die reliqua sumantur partes ut prima; tertio vero die.*

Rec. Elect. lenit. dragm. iij. syr. Rosat. solut. dragm. ij. pulp. Tomarind. dragm. j. misceantur ac in seri lactis unc. iij. dissolvantur: totum bibas mane quatuor horis ante jus, quarto die sumas mane sequentis pulv. dragm. j. mixti in sequentis Apozematis unc. iij. & olei Amygd. dulc. unc. sem.

Rec. Cinerum vitri, & Scorpionum pulveris, Lapid Spongia, & lap. Judatci, Acori, sem. Althea, Millii solis, Saxifragii ana dragm. j. sem. lactuca, & sem. frigid. majorum ana dragm. sem. Trokiscor. Alkekengi, rad. pimpinella ana dragm. ij, fiat pulvis subtilis.*

Apozema

Rec. Parietaria, rad. Alth. ana Mj. sem. petroselini, Glycyrrhiza ana unc. sem. halicacabi, unc. j. Cocu in aq. pluvia, sext. 2. & vini albißimi sext. j. ad medietatis consumptionem, & colatura melle hybernico dulceretur.

Tum quarto illo die passerulum Trogloditem sale antea conditum edas una cum cœna, Et post cœnam lumbi, pubes, & tota renum regio oleis è granis Citri & scorpion. liniantur, etsi possibile esset prædicta olea per meatum urinar. in vesicam injiciantur sitq; dein in pulvere, Apozemate, Troglodite & Oleis omni die utere, donec arenula aut lap. fragmenta una cum expulsis apparuerint.

Loco cinerum vitri sumi possunt cineres Camini & vires cinerum scorpionum supplere potest pulvis lumbricor. terrestr. probè in vino lotorum & postea exsiccatorum,

N. B. [As far as I could conjecture by the Discourse I had with the owner of the Receipt, by Ashes of Glasse he means the superfluous Saline substance, which the Glassemen are wont to call *Sandiver*; but because he did not explain himselfe so clearly, and we know not yet a way of Burning Glasse to Ashes, I think it will be most adviseable to substitute the Wood Ashes, which in the Receipt it selfe towards the close of it are appointed for a *Succedanium*.]

To the One hundred and Tenth Page;

[Where the Vertues of the *Pilulæ Lunares* are toucht at.]

THE great benefit that has redounded to many patients, from the use of the *Silver Pills*, here briefly mention'd, and commended, invites me to communicate as a considerable thing, the preparation of them, of which I do not pretend to be the Inventer; having divers years since, learn'd it by discoursing with a very Ancient and experienc'd Chymist, whose name that I do not mention, will perhaps seeme somewhat strange to those Readers that have observ'd mee not to be backward in acknowledging my Benefactors in point of Experiments, and therefore I hold it not amisse to take this opportunity of declaring once for all, that 'twere oftentimes more prejudiciall than gratefull to one that makes an advantage by the Practice of Physick, to annex in his lifetime his name to some of his Receipts or Processes; because that when a Man has once got a repute, for having a Specifick in any particular Disease or Case; his Patients, and their Friends will hardly forbear to apply themselves to him for that Medicine, though the same Medicine, but not knowne to be the same, should be made use of by a stranger, or divulged in a Printed Book. Most Patients being not apt to rely upon Medicines, that come onely that way recommen-

ded ; whereas if it were known that the Printed Receipt is the self same, which the Physitian employs, not only other Physitians would quickly make as much advantage of it as he, but many Patients would think themselves by that discovery dispens'd with, in point of good husbandry, from going to any Physitian at all, as knowing before hand the best prescription they are like to receive from him. The *Proceſſe* of the *Pilula Lunares* is this ;

The Preparation
of the *Pil.
Lunares*.

Take of the best refined Silver as much as You please, dissolve it into a sufficient quantity of clens'd Spirit of Nitre, or *Aqua Fortis*, then evaporating away the superfluous moisture, let the rest shoot into thin Chrystals; these you may in some open mouth'd Glasse place in sand, and keep in such a degree of Heat, that by the help of very frequently stirring them, the greatest part of the more loose and stinking Spirits of the *Menstruum* may be driven away, and yet the remaining Chrystals not be brought to Flow: These Chrystals of Silver you must counterpoise with an equal weight of Chrystals of Nitre; and first dissolving each of them apart in distill'd Rain-water, You must afterwards mingle the Solutions, and abstract or steam away the superfluous moisture, till the remaining Masse be dry, which you must keep in an open glasse, exposed to such a temperate heat of Sand, that the Matter may not melt (which you must be very carefull of) and that yet the adhering corrosive Spirits of the *Menstruum* might be driven away. And to both these ends You must from time to time stir the Masse, that new parts of it may be exposed to the Heat, and new ones to the Air, till you cannot discern in the remaining white Powder any offensive sent of the Spirit of Nitre, or of the *Aqua Fortis*. And lastly, You must take the Crum of good White bread, made with a little moisture into a stiff Past, and exactly mingle with the newly mention'd Magistery or Powder as much of this Past, as is necessary to give it the consistence of a Masse
of

of Pills, which you may thence form at pleasure, and preserve in a well stopp'd Glasie for use.

N.B. First the Silver employ'd in this Operation, ought to be very pure and more exquisitely refin'd, then much of that is wont to be, which here in *England* is bought for fine Silver; for if the Copper wherewith Silver-Coyns are wont to be alloy'd, be not carefully separated upon the Cupel, it may, being turn'd by the Acid *Menstruum* into a kind of Vitriol, when it is taken into the Body, either provoke Vomits, or otherwise discompose it.

2^{ly}, The Spirit of Nitre, or (which in our case comes almost toone) the *Aqua Fortis* that is us'd about this Medicine, ought to be clear'd, as our Refiners phrase it, before the Silver be put in, for (as I elsewhere Nore) in Salt Peter, there is oftentimes an undiscerned Mixture of Sea-salt, whose Spirit coming over in Distillation with that of Nitre, is apt to precipitate the Silver, which the Spirit of Nitre has dissolved. This I take to be the Reason of that practise of the best Refiners to purifie their *Aqua Fortis*, by casting in some small peice of Silver, that they may afterwards securely put into it greater Quantities of the same Metall to be dissolved. For the Saline Spirits fall to the bottome, together with the corroded Silver, which they precipitate as long as there is any of these Saline Spirits left in the *Menstruum*, which after this may be decanted cleare; and though you had put a little more Silver then needed to it, it neither does harme nor is lost, the *Aqua Fortis* preserving none unprecipitated, but what there were no more Saline Spirits to work upon, so that the superfluous Silver put in is already dissolved to Your hand.

3^{oly}, The dry Mixture obtain'd from the Solutions of Chrystals of Nitre, and Chrystals of Silver, must be often stirr'd & kept longer in the Sand, before all the offensive Spirits will be driven away, then till Experience had inform'd me, I did imagine.

Fourthly,

Fourthly, if the Chrystals of Silver be considerably Blew or Green, 'tis a sign the Silver was not sufficiently purd'd from Copper, else the Mixture we have been speaking of, will look of a White, good enough. And possibly 'twas by reason of the not being carefull to take sufficiently Refin'd Silver, and of the not knowing how to improve the Chrystals of Silver, by the addition of those of *Nitre*, and especially how to free them from the stinking and Corrosive Spirits of *Aqua fortis*, that it is come to passe, that though there being some Chymicall Writers, Processes not very unlike this, yet the Chrystals of Silver have been censur'd and laid aside as not alwayes safe even by those, who otherwise much magnifie the Efficacy of those they us'd.

Fifthly, When you are about to make up this Mixture with the Crum of Bread into a Masse, and so into Pills, 'twill not be amisse to dispatch that worke at once, for usually it leaves an ugly Blacknesse on the Fingers, that cannot under divers dayes be gotten off.

Sixthly, In taking of the Pills care must be had, that they be sufficiently lapp'd up either in a Wafer wetted with milk, or the Pulp of a Roasted Apple, or some such thing, that they may not touch the palat, or the Throat, because of the extream and disgusting bitternesse, which is to be met with in the Chrystals of Silver, and which is not the least thing, that with nicer persons does Blemish these pills

Seventhly, The Dose is somewhat uncertaine; because they worke much according to the Constitution of the Body, and especially according as it abounds with Serous humours; Wherefore 'tis adviseable to make the pills of the size of very small pease, of which one given at Bedtime, is a sufficient Dose for some Bodies, others will require two; and in some we must ascend to three; and if the Patient be Hydropicall, or be otherwise much molested with Serous Humours, it is observable that sometimes one dose will worke two dayes,

The Dose and
use of these
Pills.

or four days, (may be five or six) successively, but yet moderately and usually, without weakening the patient, in proportion to such copious Evacuations.

Eighthly, Besides the Dropsie, wherein we have mention'd this Remedy as a Specifick, it often proves very available in other Cases, wherein Men are troubled with serous Humours. But the first distempers, which I heard it Magnified for, were those of the Head, and *Genus Nervosum*; and a great *Virtuoso* of my acquaintance that inherits a disposition to the palsey, has several times told me, that if when he begins to find himself disordered, he take a dose of these pills, he is thereby constantly reliev'd. But of the particular Cases wherein we have had opportunity to take notice of their Effects, we have not now, but may perchance another time have leisure to entertain You.

Lastly, That skilful and successful Chymist Dr. N.N. who doth much both use and esteem this Remedy, being desir'd by me to let me know, if he had any objections against it, informs me, that when he hath given these Pills oftentimes, and without intervals, though they did not either Salivate or Vomit, or much weaken the Patient; yet they would at last be attended with a kind of Incipient *Leucophlegmasia*, which he easily prevents by intermitting for a while the use of the pills, after every second or third time that he administers them, and giving when he expects it to be requisite, some *Crocus Martis*, Extract of *Juniper*, or other astringent or Hepatick medicines to corroborate the *Viscera* and preserve their Tone.

To the One Hundred thirteenth Page.

(Where mention is made of the Cure of one, concluded to have a Gangrene, by an inward Medicine.

THE Cure mention'd in this place, having been perform'd by that Medicine, which from the Name of that Great Commander as well as *Virtuoso*, who was the Author of it, passes

passes under the Name of *Sr. Walter Rawleighs Cordial*, and this being but one of many remarkable (and some of them stupendious) Cures which have been wrought by it from time to time, especially of late that it hath been more us'd I am induc'd to annex here the yet unpublish'd Receipt, partly, because there are divers Receipts that are each pretended to be the true, magnify'd by their several Possessors; And I had the liberty of looking it out in a Receipt-Book, preserved by the Authors Son; and partly because, though I will not affirm, that a skilfuller or more promising Composition of the same Ingredients could not have been devised; Yet the following Receipt has been abundantly recommended by Experience. And I remember that but a while since, a Person of Note having sent to me, to desire a taking of this Cordial for a certain Knight, who after all that Skillful Physitians could do, had long lain a dying; I the other day chanc'd to meet this Knight at *White-Hall*, well, lively, and with a Face whose Ruddiness argued a perfect Recovery, & yet he is not very farre from seventy Years of Age, and had before he grew so ill, long conflicted with a tedious Ague, and fever, which had reduc'd him to that Extremity, when the Cordial was brought, that, as himself told me, he neither was sensible when they gave it him, nor had known what he did, or what was done unto him, during the space of several dayes before.

*Sr Walter Rawleighs Cordial, after Sr R. K. his way
(set down verbatim as I the Authour received it.)*

TAKE Burrage-Flowers, Rosemary-Flowers, Marigold-Flowers, Red July-Flowers, *Rosa-solis*, Elder-Flowers, of each one Pottle, after they are dryed in the Shade.

Take also of Scordium, Carduus, Angelica, Baulm, Minor Marjoram, Setwall, Betony ana four handfulls, after they are dry'd in the Shade.

Take

Take also of the Rinds of Sassafras of Virginia, *Lignum A-*
lbes, ana, four ounces beaten to powder; of Kermes, Cubebs,
 Cardamoms, Zedoary, *ana* one ounce; of Saffron half an ounce;
 Juniper Berries, Tormentil Roots, round Birthwort roots, of
 each one ounce, of Gentian Roots half an ounce.

Draw the Tincture or Extract of these with Spirit of Wine
in Balneo, and save all the ingredients after you have taken out
 the tinctures, & burn them, & put their salt into their tinctures.

Take six ounces of the Extracts of all these with their Salt,
 and put thereto of the Tincture of Coral three ounces; *Terra*
Sigillata four ounces; Pearl prepar'd two ounces; Bezar-stone
 three dragmes; Hart's-horn calcin'd four ounces, Amber greece
 four dragmes, Musk *gr. xxx*; Sugarcandy one pound and an
 half, ground very fine, and searfed through a fine Searse.

Then the musk & amber must be ground, and by litle and litle
 mingled with it, the more you grind the Amber the better:

Then put to the Sugarcandy all the dry Materials before di-
 rected, and make all as small as possibly you can.

Then upon a great hollow grinding Stone mingle the Tin-
 ctures, and dry things together: (which must be done by a
 strong man used to that work:) and whilst tis in grinding, put of
 syrrup of Limmons, and syrrup of red-Roses equal parts into
 it, else it will be so dry, that twill neither grind nor mingle.

How to make the Tincture of Coral
for this Cordial.

Take eight ounces of Coral, and put it unbea-
 ten into a calcining pot unluted, and let it stand
 twenty four hours in a calcining or Glasse-fur-
 nace, till the Coral be as white as Snow; then
 put it in three quarters of distill'd Vineger in a
 long Glasse with a narrow mouth, and with ano-
 ther small Glasse or Vial put into the mouth of
 it, the Belly upwards, to save the Vineger from
 wasting. *Thus*; And set it in a sand-furnace, so
 as the Sand may be as high as the Vineger.

Qq

Let



Let it boyl without intermission twenty four Hours, by which time Vineger will become red; so, when tis cold, pour off the Vineger into a Glasle-Bason, or a Bell-Glass, and vapor away all the Vineger *in Balneo*, and gather the Coral, being perfectly dry, for your Use. You may strike down your Pearl with Oyl of Vitriol, and Oyl of *Sulphur*, equal parts, which is accounted the best way to prepare the pearl: but Sr. R. K. did use to prepare his pearl by juice of Limmons.

[The Dosis for a Man is about the bignesse of a small Hesel Nut, but where prevention is onely aim'd at, or some such use as the dissipating the Fumes of the Spleen, as they call it, the bignesse of an ordinary Pease, may suffice; so in urgent cases the Dose may be increas'd to the quantity of a Nutmeg. It is usually given by it self upon an empty Stomach (the Patient being kept warm after it to promote Sweat) in Feavers, want of Spirits, violent Fluxes, and severai other distempers, where Diaphoreticks and Antidotes are proper, and (especially) potent Cordials are requir'd.]

[To the One Hundred thirteenth page,
Where a Receipt that cur'd Fistula's is mentioned.]

A Water for a Fistula, and all manner of Wounds and Swellings, or old Ulcers, Cankers, Tetters, Boiles, or Scabs in any place, or Green Wounds.

TAKE of Bole-Armoniack four Ounces, of Camphire one Ounce, of white Vitriol four Ounces; Boile the Camphire and the Vitriol together in a litle Black Earthen pot till they become thin, stirring them together till they become hard in setting; then bruise them in a Mortar to powder, and beat the Bole-Armoniack it self to powder, and then mingle them together, and keep the powder in in a Bladder

Bladder, till such time You use it; then take a pottle of Running Water, and set it on the Fire till it begin to seeth, then take it from the Fire, and put in three good Spoonfuls of the powder into the Water whilst it is hot, and after put the Water and powder into a Glasse, and shake it twice a day to make the Water strong: But before You use it, let it be well settled and very clear, and apply it as hot as the Patient can well suffer it; and lay a clean Linnen cloath, four double, to the Sore, it being wet in that Water, and bind it fast with a Rowler to keep it warm; do it Morning and Evening, till it be whole. This Water must be put into an Oyster-shel, not in a Sawcer when you dresse the Sore, for the Pewter will suck it up. Remember you put three as good Spoon-fuls of powder as You can presse into the Spoon. Take heed no one drink of this water, for it is poyson. To make it stronger, beat an ounce of Aloem to powder, and mingle it with the other powders.

Take of Bole-Armoniack half an ounce, white Vitriol one ounce, of Camphir two Ounces, make them all into powder; then take a pottle of Smiths-water, and as much Spring-water, and mingling them, set them upon the Fire, as soon as it begins to seeth, put in the powder very softly, stirring it all the while; as soon as the powder is in, take it off the Fire, and dresse the wound with it twice a day, laying a Cloath fouled four times and wetted in the water, it being very hot, and so applied to the wound.

NB. [This is the Receipt *Verbatim*, as I find it among my old papers, but I am not sure that among those I cannot now come by, there may not be something concerning a way of making a small pliable Tent that may accommodate it self to the crooked Figure of the Cavity of many Fistula's. For me thinks I remember, that the Chirurgion prescrib'd the conveying the Medicine by the means of such a flexible Tent a great way into the Cavity, if not to the Bottom of the Fistula, which was thereby to be cleansed.]

To the One Hundred fourty first page.
Where Soot is mentioned.

Soot, *Pyrophilus*, is a production of Fire, whose Nature is almost as singular, as is the manner of its being produc'd, for it is (if I may so call it) a kind of Volatile Extract of the Wood it proceeds from, made in stead of a *Mentruum* by the Fire, which hastily dissipating the parts of the Body it acts on, hath time enough to sever it into smaller particles, but not leisure and aptitude to reduce it into such differing substances as passe for Chymical or Peripatetick Elements, but hastily carries up the more volatile parts, which being not yet sufficiently freed from the more fix'd ones, take them up along with them in their sudden flight, and so the Aqueous, Spirituous, Saline, Oleaginous and Terrestrial parts ascending confusedly together, do fasten themselves to the sides of the Chimney in that loose and irregular Form of Concretion, which we call Soot: An Enquiry into whose Nature, as it may be consider'd in the survey of the distinction of Salts, must be elsewhere lookt for; our mentioning it at present, being onely to take occasion to tell You, that as ill sented and despised a Body as it is, *Hartman*, (one of the most experienc'd and happy of Chymical Writers) scruples not to reckon the spirit and oyl of it among the Noblest *Confortantia*, such as prepar'd Pearl, Coral, Amber-greese, and other eminent Cherishers of Nature. His preparation is for substance this: Take of the best Soot (such as adheres to the lower part of the Chimney, and shines almost like Jet) what quantity you please, and with it fill up to the Neck a very well coated Glas Retort, or an Earthen one, and luting on a capacions Receiver, distil the matter in an open fire intended by degrees, whereby you will drive over the Phlegm, the whitish Spirits, and the Oyl first of a yellow Colour, and then of a red, separate the phlegm,

Hartmans
preparation of
Spirit and Oyl
of Soot.

Phlegm, and for a while digest the spirit and the oyl together, on which afterwards put halt the quantity of spirit of Wine, and Distil them several times, whereby you will obtaine together with the spirit of Wine, the Spirit of Soot, and also a very depurated Oyl, smelling like Camphire. Out of the Calcin'd *Caput mortuum* after the common way extract a salt, which *Hartman* commends as a most excellent curer of exulcerated Cancers; This Salt, saith he, is drawn with Vineger, in which Liquor is a cold moist place, it is again Dissolv'd, and therewith the Cancerous Ulcers being once or twice annointed, the venenosity will be visibly drawn out like a Vapour, and then the forementioned Oyl being lightly sprinkled upon the place will breed on it a kind of Crust like a skin, which spontaneously comming off in five or six Dayes, will by its falling off, argue the Consolidation of the Ulcer. What this so extoll'd Remedy will perform I know not, having never made trial of it, nor thinking it very likely, that a bare Alcalizate Salt should have such *Specific Vertues*, nor is it requisite I should insist on it, being here to discourse to you of the distill'd Liquors of Soot, in prosecution of which design, let me tell You, that *Hartman* prescribes the administring of the spirit from six to ten Grains, of the Oyl from two or three drops in Wine, or any other convenient Vehicle: and concerning the oyl he addes, That if three drops of it be given in Vineger to an almost gasping Man, he will be thereby wonderfully refresh'd, and as it were reviv'd, to which he annexeth this Prognostick, that if the Remedy produceth copious Sweats, it will recover the Taker, but if not, he will Die.

That this spirit of Soot describ'd by *Hartman* may be a very good Medicine I am very apt to think; but because tis not a meer spirit of Soot, but a mixt one of spirit of Wine, and spirit of Soot, we have rather chosen to proceed with the Soot (of Wood) without addition, both as to the Distillation

Hartm. Prax.
Chim. p. 12.

*The Authors
directions concerning
preparations from
Soot.*

lation of it, and the ordering of the distill'd Liquors, after the manners to be mentioned ere long, when we shall acquaint You with our preparations of Bloud and Harts-horn, which if You please to apply to Soot, You may save Your self, and me, the labour of Repetitions. Yet it may not be amiss to advertise You here of two things: The one, that if you employ very good and fat Soot, and fill up the Retort with it to the Neck; You must be very careful to encrease the Fire orderly, and but by moderate Degree, or else You may chance to make the matter boil over out of the Retort into the Receiver; as it lately happen'd to us, when having warily order'd the Fire for several hours, we thought our selves past any such danger: and the other, that as to the Medicinall Virtues of the Spirit, and salt of Soot, I shall not now particularize them, partly that I may save time, and partly because they may be well enough gather'd from their affinity to the Volatile Salts and Spirits of animal substances hereafter to be treated of: and from what I shall have occasion to say, of the perfuming of the salt Soot towards the close of this

APPENDIX.

To the one Hundred Fourty third Page.

*Of the uses of
the Preparations
of Urine.*

URine is a Body, which, as homely and despi'd as tis wont to be, may, by skilful waies of ordering it, be made either alone, or in conjunction with other Ingredients, to afford such a variety of useful Substances, that I find *Reusnerus* publish'd an Entire Treatise, which yet I never could get sight of, under the Title of *Synopsis Remediorum ex Urina preparatorum*, besides what other Chymists have since divulg'd on the same subject, which I forbear to mention, because severall of them I have not tryed, and many others I think scarce worth trying. But because even all our own Observations concerning the Preparations and uses of things

afforded

afforded by Urine, would take up more time and Room; then I can now allow them, I shall here onely take this occasion to intimate thus much in general, that the Spirit and Salt of Urine may be made far greater use of, than Men yet are prone to think; not onely in Physick, but in Chymistry, and perhaps I durst adde in Natural Philosophy too. And though *Helmont* be not wont to lavish his praises upon worthlesse Remedies, yet he calls it *Nobile ad Ictericum, aliosq; morbor, Remedium*. And in another place, speaking of the Saline Christals of Urine, he hath this Expression: *Quae quanquam ad Veteres Excrementorum Oppilationes conferunt, nihil tamen adversus Lithiasin*; which seems, by denying to the Salt of Urine some Virtues ascrib'd to it by many other Chymists, to bring some credit to his praises of it. (And indeed a friend of mine, that has try'd it in the Jaundise, affirms it to deserve the Commendation he gives it in that disease.) And though I fear our Author Hyperbolizeth, where he (elsewhere) thus writes: *Spernit eos sapientia* (he means sure, that which is proper to the Spagyrist) *qui Materiam ex qua dispositiones, Contenta, Proprietates, Progressum & significationes Lotii addiscere recusarent per ignem*; Yet perhaps the Hyperbole is not altogether so extravagant as most Readers will think it. And I remember, that a while ago, conferring with the publick Minister of a Forreign Prince, who is a very inquisitive and experienc'd person, He freely told me, that though he had Travelled very much, and divers times not in a Capacity, yet the greatest Chymist that ever he could make acquaintance with, us'd to tell him, that Salt of Urine was so precious a thing, that 'twas a pitty it should be us'd in ordinary Diseases; But what his Reasons were for valuing it so much, he would not declare, and therefore I shall lay no great weight upon his Testimony. And yet I must not at this time particularly declare, upon what account it is that I do so value the volatile Salt of Urine, of whose

*De Lithiaſi. c. 3.
n. 3.*

whose Vertues (whilst tis single) I shall onely in a word ob-
serve to you now (what is pertinent to the occasion of my men-
tioning it at present,) namely, that when tis well prepar'd
[according to the way plainly enough, though but very briefly
touch'd already] it differs so little in smell, tast, volatility, pene-
trancy, and some other manifest Qualities, from the Salt of
Hart-horn, and that of Mans blood; that such effects, though
perhaps somewhat lesse powerful, may be not improbably ex-
pected from it, as are produc'd by the other.

To the One Hundred Fourty fourth page.

of the Pre-
parations of
Mans blood.

*Though I have not in this place made any absolute Promise, of an-
nexing any thing, more particular touching the Spirit of
Blood; and though I cannot now find, and I fear may have lost
those of my Papers concerning that subject, which were the least
unaccurate; Yet, setting aside former Tryals, a recent Account
brought me by a Physitian, whom I had entrusted with some of
it, represents it as so very good a Medicine, that I am content
to subjoyn, what particulars I have lately found among my lost
Papers concerning it, as I many years agoe sent them to a
friend; and this I rather do, because there being annexed to the
Processe divers Observations of general Import to such kind of
Preparations, they will be the better understood with it, then
without it, and I have not now the leisure to new-mould them.*

Thus then;

TAKE of the Blood of an healthy Young man as much
as you please, and whilst it is yet warm, adde to it
* twice its weight of good Spirit of Wine, and incorporating
them well together, shut them carefully up in a convenient
Glasse Vessel, wherein the matter must be set to digest in

* This, if I mi-
remember not,
was the Propor-
tion I employed
in the exallest of

of my Experiments of this kind, but it seems to be essential to the goodnesse of the Remedy; the Spirit of wine
serving chiefly but to keep the Blood from corrupting.

Balneo

Saliva, or Horse-dung, for six weeks, or more; then in a Glass head and body, placed in Ashes or Sand, draw off with a gentle heat as much Liquor, as will come over without necessitating you to impresse any *Empyreuma* upon it, the remaining matter must be taken out and put into a strong and capacious Retort, which being plac'd in Sand, and accommodated with a large Receiver carefully luted to it, the matter therein lodged must be gradually pressed with a vehement Fire, which must at length be encreased till it be strong enough to give the bottom of the Retort a read Heat. There will first come over (after perhaps a little Phlegm) Spirit, either accompanied or closely followed by a copious volatile Salt, fastning it self to the sides and top of the Receiver; and much about the same time there will also come over an Oyl or two, or more, (for I have not observed the oleaginous part to come constantly and regularly after the same manner) the Receiver being taken off, all that it contains may be poured together into a convenient Vial, to be therein digested for a Moneth, if you please: or otherwise without that previous digestion, you may wash down the volatile Salt adhering to the sides of the Receiver, with the Spirit and Oyl well shaken about it, and pour altogether into a large Glasse-Funnel well lined with Cap-paper, first moistned with the Spirit of fair Water, through which the Spirit and as much of the Volatile Salt, as it and the Phlegm can dissolve, will passe first, leaving the Oyl behind them in the Paper, which must be seasonably set aside, or else the Oyl also, though more slowly, will passe through the Filtre: The Phlegm, Salt, and Spirit must be rectified with a very gentle heat, so often, till the Phlegm be perfectly separated, and they leave no faces: The oyl also may be rectified two or three times from its own *Caput mortuum* calcin'd, or else from Salt of *Tartar* to deprive it of its muddiness. The distempers wherein this *Arcanum* or Spirit of Man's Blood is

proper, are divers, but chiefly Astmah's, Epilepsies, acute Feavers, Plurisies, and Consumptions. But to comply with my present hast, I shall advertise You in the general, as to the use of this and the other Remedies to be subsequently mention'd, that for them I must refer You to the particular Narratives, which I shall scarce, if You seasonably desire them, refuse you: And in the mean time, because the volatile Remedies are near enough of kin to each other, I shall adde to this first Proceffe (which is at the least one of the noblest of them) some Observations of a more general nature, we may both us avoid the trouble of needlesse Repetitions,



Observations.

Observations
touching the
manner of draw-
ing the Volatile
Salts and Spirits
of Salt & Blood
and other Sub-
stances belonging
to the Animal
Kingdom.

I. Ignore not, that there are extant in *Burgravius*, *Beguinus*, and divers other Chymical Authors, very pompous and promising Processes of the Essence of Man's Blood, to which they ascribe such stupendous faculties as I should not only wonder to find true, but admire that they can hope the Reader should believe them so. But of these Preparations, some being, as that of *Burgravius* in his *Biolychniū*, very mystical and unlikely; and others, like *Beguinus* his *Q. E. Sanguinis humani*, exceeding laborious and not so clear, I have never put my self to the trouble of making them, but I shall be very forward to acknowledge their excellency, if any Man shall vouchsafe me an Experimental Conviction of it. For though I think the preparation of Blood no bad one, yet I am far from daring to affirm there cannot be a better.

2. He that intends to have any considerable quantity of this spirit and salt, must provide himself of a large proportion of Blood, or else he is like to fall short of his expectation; because as full of Spirits as Blood is supposed to be, it yields commonly (at least the best I have hitherto met with) no less than two thirds, or more, of Phlegm, besides a not despicable

cable quantity of terrestrial and unserviceable Matter.

3. It is requisite, both that the Retort wherein the dried Blood is distilled be pretty large and strong, and that the Fire be very carefully and gradually administred, least either the copious Fumes break the too narrow Vessels, or the Matter too hastily urged boil over into the neck of the Retort or the Receiver, both which dangers this Advertisement may help You to avoid at a cheaper rate, than I, who have not been forewarn'd of them but by unwelcom Experience.

4. There is a Friend of mine, an excellent Chymist, whose rare Cures first gave me a value for Remedies made of Blood, who useth (as himself assureth me) to mingle with the Spirit that other Liquor, drawn over at first in a Head and Body, and twice or thrice rectified by it self. But that Liquor consisting almost totally of the Spirit of Wine, and the not over-grateful Phlegm of the Blood, though there may perhaps be passed into it some of the more fugitive particles of the volatile Salt: Yet they being so few as scarce discernable, this Liquor seems fitter to be made a Vehicle, than an Associate of our Spirit, and perhaps too is not in all cases the most proper vehicle in which it may be administred: (though if it were not for the spirit of Wine, I should somewhat suspect that the Phlegm, though so destitute of the more active ingredients, as to be fit to be kept separated from them, may not it self be quite devoid of Specifick Virtues.) But my esteem of the Artist I have mentioned, doth make me think it fit to acquaint You with his practice, notwithstanding that hitherto his authority be the chief thing that recommends it to me.

5. Divers ways may be propos'd of purifying this spirit and Salt we are discoursing of, but having tried several, that which I now use is this that follows: I put the salt Phlegm, and Spirit together, in one of the highest and slenderest Bo-

dies I can get, that the Phlegm might not be able to ascend easily into the Head, and that the volatile Salt may be the better separated. Then in a very gentle heat (I most use that of a Lamp Furnace) there will ascend pure white and volatile Salt, adhering to the cheeks and nose of the Glass-head, which if I desire by it self, I sweep it away before the Spirit begins to rise; but most commonly I suffer the Distillation to proceed, and the ascending Spirit to carry down part of the volatile Salt into the Receiver, and so I continue the same degree of heat, till there arise so weak a Spirit that it plainly begins to dissolve the volatile Salt: then shifting the Receiver, I reserve the strong Spirit and volatile Salt by themselves, and take the succeeding weaker Spirit by it self also; to which if I please to fortifie it, I adde as much of the volatile salt, formerly reserved, as it is able to dissolve. In the bottom of the Cucurbit or Vial there will remain a phlegmatick kind of Liquor, which usually contains some of the Salt or Spirit, and sometimes too (which is somewhat odde) some of the oleaginous part of the blood, which did not before appear to have been associated with the Spirit, and to have passed through the Filtre with it. This nauseous Liquor may be kept by it self till You have a sufficient quantity of it, to be worth the trouble of severing from it the nobler parts. The spirit and salt above mentioned may be again rectified, *per se*, with the like gentle heat as before, so often, till they leave behind them no *feces*, nor Phlegm at all. But this is requisite to be done only when, to master some stubborn Disease, the Medicine is to be exalted either to its supreme, or at least to some approaching degree of Purity and Efficacy, for otherwise so exquisite a Depuration is not alwaies necessary.

6. As for the oleaginous part which the Fire forceth out of Blood, my observations of it hitherto have so little agreed, that I dare as yet speak but hesitantly concerning it. For sometimes but one Oyl hath been drawn over, sometimes

two: And I remember, last Year, a parcel of Blood, that was kept in a Dung-hil for many Moneths, yeilded us a blackish and muddy Oyl, a purely red one, and another of pale Amber Colour, which would not mingle with the darker, of each of which sorts I yet reserve some by me. This difference may possibly proceed partly from the previous preparation, or unpreparednes, of the Blood, and partly from the various administration of the Fire employed to distill it. But for the most part we find these Animal substances (if the degrees of fire be orderly administred, and the heat sufficiently intended towards the close of the Distillation) to yeild a double Oyl: the one more light and pure, which swims upon the Spirit; the other more muddy, adust, and ponderous, which sinks to the bottom of it. The use of these Oyls hath, by reason of their Fetidnes, been by most Authors absolutely rejected; and even those few that do not altogether reject them, forbid their inward use, and allow them to be but externally employed: But considering, *Pyrophilus*, how much of the efficacy both of Plants and Animals is observed to reside in their oleaginous part, it seem'd not improbable to me, that these Oyls might deserve a better usage, than either to be wholly thrown away, or confin'd to outward Services; and therefore having not long since given a Friend of mine some pure, yellow Oyl of Man's blood, dissolved in Spirit of Wine, to try upon a Patient of his, sick of a Hectick Fever (in which Disease I had seen the spirit of Blood very succesful) within a few days he brought me word of the unexpected recovery of his Patient, to whom he administred our Medicine (that I may not conceal from You that circumstance) in *Balsamus Sameeb*, made with Spirit of Vineger instead of Spirit of Wine; the remaining part of this yellow mingled Oyl I keep yet by me, to make further tryals with it. And that such Oyls may not be lost, I have been attempting (for I am yet upon my tryals) several ways

to

to make them serviceable. Some of them that are of a more pure and defecated nature, I have (which is not unworthy your noting) found capable of readily uniting with Spirit of Wine, with which they may be allayed at pleasure: In others I have separated the finer and more volatile part, by drawing them over with a very gentle heat in a Retort half full of Water, which will carry over the lighter part of the Oyl with it into the Receiver, wherein the Oyl will swim upon it, and may be afterwards sever'd from it by a separating Glasse, or any other convenient way (but I fear that this method, though it finely clarifies Oyls, may rob them of the best part of the Efficacy they may perchance derive from the latent admixtion of somewhat of the volatile Salt:) at the bottom of the Retort there will remain a dark and thick substance, whose nature I have yet had opportunity to enquire into: Out of some Oyls (drawn from unprepared Materials) which would not dissolve in Spirit of Wine, have, by digestion with Spirit of Wine, drawn much of the scent and taste, the Spirit probably imbibing some of the finer parts of the Oyl, or else associating to it self some volatile Salt that yet lay lurking in it: For sometimes I have observed Oyls, after long keeping, to let fall a volatile Salt undiscerned in them before. Having also sometimes mingled the heavier and lighter Oyls of the same body with dephlegmated spirit of Wine, and in a low Retort drawn over what will rise in a very gentle heat (inferior to that of a *Balneum*) I have found the spirit of Wine to carry over with it so many of the more subtile and active parts of the Oyl, that it was more richly impregnated therewith, than you will be apt to expect. But of what use this Oleaginous Spirit may be in Physick, I have not yet had time to consult Experience, which I hope will, ere long, teach me better ways of improving the rejected Oyls we have been speaking of, than are those almost obvious ones hitherto mentioned, wherein I am
 very

very far from acquiescing, especially since I cannot but suspect but such active parts of such Concretes, would be found very capable of a great improvement, if we were as skilful to give it them.

7. The terrestrial Substance that remains after the Liquors are drawn off, if the Blood have been duely prepared, affords but so inconsiderable a quantity of fix'd Salt, that unlessse the *Caput mortuum* be exceeding copious, the *Alkali* will hardly be worth extracting: Besides, that if it could be obtain'd in a not despicable quantity, I should, what ever is pretended, very much doubt whether it would be endow'd with very extraordinary vertues, the violence of the Fire usually depriving fix'd Salts of the Specifick Qualities of their Concretes: and even in the first Salt of Serpents themselves, I have not discerned other than the wonted properties of *Alkalizate* Salts.

8. Because you may sometimes not have the leisure to wait six weeks for the Preparation of Blood, and because oftentimes the occasion of using the medicines we have been describing, may be so hasty and urgent, that unlessse some speedy course to relieve them be taken, before the Physick can be prepared, the Patients will be dead. I think it not amiss, *Pyrophilus*, to advertise You, That though without any previous preparation of Blood you should immediately distill it, provided an orderly gradation of heat be carefully observed, it will yeild You a reddish Spirit, and (besides an Oyl or two) a volatile Salt, which being rectified, are so little interior, in any properties discernable by the smell or taste, to the Salt and Spirit of predigested Blood, that tis very probable their Efficacy will emulate, though not altogether equal that of the more laboriously prepared.

9. And because tis difficult to get the Blood of healthy Men, and perhaps not safe to use that of unsound persons, and because many have a strong Aversion, and some an

*an insuperable, though groundlesse abhorrency, from Medicines made of Mans Bloud, I have thought it not amisse to try, whether that of some other Animals, prepared the same way, might not afford us as hopeful Medicines: And because the Bloud of Deer is chiefly (and perhaps not carelessly) commended by Authors, we have handled it according to the foregoing process, & thereby obtained of it a Spirit, and Salt, and Oyl, whose penetrancy, and other resemblances, make us hope that they may prove good *Succedanea*, in the defect of those Analogous Remedies (drawn from Humane Materials) which we have been treating of.

And to this let me, *Pyrophilus*, on this occasion, annex this Advertisement, that though in these Papers, and what I have further written of Preparations of this nature, I name not any great number of Concretes, as having drawn their volatile salts and Spirits, yet I have endeavoured in these Discourses to give You in the instances I insist on, so much variety of Examples, that either by the Processes therein set down, or by the Analogy to them, You may, I suppose, be directed with the help of a few Tryals, to obtain the volatile Salts and Spirits of most Concretes that belong to the Animal Kingdom, and that are capable of affording any. For by the method we prescribe, a little varied according to the exigences of particular Bodies to be distill'd, we have drawn the Spirits, Salts, and Oyls of Sheeps-bloud, Eels, Vipers, &c. the latter of which yeild a Salt and Liquor, which in *Italy*, by divers Learned men, is superlatively extoll'd against Obstructions, foulness of the Bloud, and I know not how many Diseases proceeding from these two general Causes. And though I dare not deny that divers of those Praises may be well enough deserv'd by the Remedies, to which they are ascrib'd, yet I am not apt to think them much superior to the generality of volatile Salts: And eeven the Spirit and Salt of Sheeps bloud it self, did, by their penetrancy

trancy of taste, and fugitiveness in gentle heats, promise little less efficacy than those others so much celebrated Medicines.

10. Nor is it onely by being administred it self, that one of this sulphureous and subtle kind of Spirits may become a good Remedy, but also by its being made a *Menstruum* to prepare other Bodies: For it will extract Tinctures out of several sulphureous and resinous Concrets, whose finer parts, by being associated with so piercing a *vehicle*, may probably gain a more intimate admission into the body, and have their virtues conveyed further than otherwise they would reach. And a Learned Doctor, to whom I recommended such kind of Remedies, confessed to me, that by the bare extractions of appropriated Vegetables themselves, with Spirit of Urine, he perform'd no small matter. But one difficulty You may meet with in drawing the Tincture of Minerals, and other very compact Bodies, even with good spirit of Urine; (for that I account to be the cheapest of these volatile *Menstruums*, and the most easie to be obtain'd in good quantities.) For we have found, but with a little heat, the more fugitive Particles to ascend to the upper parts of the Glas, and there fasten themselves in the form of a Salt; by whose recess, the debilitated Liquor was disabled from drawing the Tincture so powerfully as was expected, wherefore we were reduc'd to make our Extractions in short-neck'd Glass-Eggs or Vials exquisitely stopt, (which may also be plac'd stooping in the Sand) and when we perceiv'd much to be lodg'd in the necks of the Vessels, by barely inverting them, the hot Liquor soon reimbib'd the Salt, and was fit to be plac'd again in Sand; to that notwithstanding this difficulty, we are able by this means, in no long time, to impregnate the Spirit of Urine, or of Harts-horn (for I do not perfectly remember which it was) with the Tincture of Flowers of Sulphur, which may probably prove a noble Medicine in divers affections of the Lungs, since in them these volatile Liquors alone have

How to draw
Tinctures, as of
Sulphur &c.
with the Saline
Spirits.

S f

been

been found very effectual. And I remember, I have sometimes made much a shorter and more odd Preparation (which at any time you may command) of crude *Sulphur*, whereby in not many hours I have, by the means of Salts, brought over such a sulphureous liquor or Tincture, as even in the Receiver was of a red colour, as well as of a strongly Sulphurous scent.

[To the Page 154, 155, &c. where *Ens Veneris* is treated of.]

How the Author
first hapned upon
the preparation of
Ens Veneris.

But before I enter upon particulars, I think it will not be amiss to tell You how this preparation first occur'd to Us, because by that information Your happier *Genius* may peradventure hereafter be prompted to improve this Remedy, or to devise one more approaching to the Nature and Excellency of that which we endeavour'd, but with very imperfect successe to light on, or equal, by our *Ens Veneris*. I must then tell you, that an industrious Chymist (of our Acquaintance) and I, chancing to read one day together that odde Treatise of *Helmont*, which he calls *Butler*, when we had attentively perus'd what he delivers of the Nature as well as scarce credible virtues of the *Lapis Butleri* he there mentions, we fell into very serious Thoughts, what might be the Matter of so admirable a Medicine, and the hopesullest manner of preparing that Matter. And having freely propos'd to one another our Conjectures, and examin'd them by what is deliver'd by *Helmont*, concerning the Preparation of *Butler's Stone*, or some emulous Remedy, we at length concurr'd in concluding that either the *Lapis Butleri* (as our Author calls it,) or at least some Medicine of an approaching Efficacy, might (if *Helmont* did not mis-inform us) be prepar'd by destroying (as far as we could by Calcination) the body of Copper, and then subliming it with *Sal Armeniak*. And because the Body of *Venus* seems lesse lock'd up in

good

good Vitriol, than its Metalline form, we concluded that it was best to calcine rather the Vitriol, than the Copper it self, and, having freed the *Colcothar* from its separable salts, so to force it up with *Sal Armoniack*. But the person I discours'd with, seeming somewhat diffident of this Process, by his unwillingness to attempt it, I desir'd, and easily perswaded him at least to put himself to the trouble of trying it with the requisites to the work w^{ch} I undertook to provide, being at that time unable to prosecute it my self for want of a fit Furnace in the place where I then chanc'd to lodg. And though at first we did not hit upon the best and most compendious way, yet during the sublimation, he being suddenly surpriz'd, as both himself and his domesticks two daies after told me, with a fit of sicknes, attended with very horrid and seemingly Pestilential symptoms, was reduc'd to take some of this Medicine out of the Vessels before the due time, and upon the use of it found, as he told me, an almost immediate Cessation of those dreadful symptoms, but not of the Pale- nesse they had produc'd. This first prosperous Experiment emboldned us to give our Remedy the Title of *Primum ens Veneris*, which, for brevities sake, is wont to be call'd *Ens Veneris*, though I am far from thinking that it is the admirable Medicine to which *Helmont* gives that name, at least if his *Ens Veneris* did really deserve half the praises by him ascrib'd to it. But such as Ours is, I shall now (as time and my yet incomplete Trials will permit) acquaint you with that Process of it, which (among some others) we are most wont to employ, as the most easie, simple, and genuine.

Take then of the best *Hungarian*, or if you cannot procure that, of the best *Dantzick*, or other good Venereal Vitriol, what quantity you please, Calcine it in a strong fire, till it be of a dark red, Dulcifie it by such frequent affusions of hot Water, that at length the Water that hath past through it, appear full as tastelesse, as when it was pour'd on it. Let this

*The Process us'd
by the Author for
the making of
Ens Veneris.*

thus exquisitely dulcified *Colcothar*, when it is thorowly dry, be very diligently ground with about an equal weight of good *Sal Armoniack*, and let this mixture be put into a Glasse Retort, and either in as strong a heat as can conveniently be given in Sand, or else in a naked fire, force up as much of it as you can to the top of the neck of the Retort, and this Sublimation being ended, out of the broken Retort (laying the *Caput mortuum* aside) take all the Sublimate, and grind it well again, that if in any part the *Sal Armoniack* appear sublim'd by it self, it may be reincorporated with the *Colcothar*; resublime this Mixture *per se* in a Glasse Retort as before, and if you please you may once more elevate this second Sublimate, but we have not found That alwaies needful. And for the better understanding of this Process, be pleas'd to take notice of the following particulars.

Divers particular animadversions concerning the Preparations.

First, We have alwayes preferr'd such Vitriol as abounds with Copper, before our common English Vitriol, about the making of w^{ch}, those that keep the Copperas work at *Detford* are wont, as themselves have upon the place inform'd me, to use good store of Iron to increase the quantity of their Vitriol.

Secondly, if You be unwilling to loose the Phlegm, Spirit, and Oyl of that Vitriol with which you design to make *Ens Veneris*, You may distill them away in an earthen Retort, or one of Glasse well coated. But though it be well known that the distillation of Oyl of Vitriol requires a very intense and lasting Fire (so that unlesse you have need of the Liquors, the best way will be without any Ceremony to calcine the Vitriol in a naked fire and open, yet afterwards it will be for the most part requisite farther to calcine the *Caput Mortuum* in an open Vessel. For you must take notice, that unlesse the Vitriol be very thoroughly calcin'd, it will be very troublesome for You to Dulcifie it, and sometimes we have observ'd that the *Caput mortuum* which look'd red, and seem'd indifferently well Calcin'd, hath been, almost like

Crude

Crude Vitriol dissolv'd in the fair Water which was pour'd on it to dulcifie it. The weight of the *Calx* in reference to the Vitriol, of which it was made, we cannot easily determine; but we have sometimes found it necessary to reduce the Vitriol to less, perhaps much lesse than half its weight to make it fit for Dulcification.

Thirdly, the Water that hath been pour'd off the first and second time to edulcorate the Calcin'd Vitriol, may be filtrated and steamed away, till it come almost to the consistence of a Syrup or Honey, and then may be put into a cold place to shoot; for after this manner we have sometimes had many very regularly figur'd Chrystals or Graines of Salt, I say sometimes, because sometimes also you may find it necessary to abstract all the Water, to obtain the whitish salt of Vitriol, which we have known us'd as a good Vomit, and which *Angelus Sala*, none of the least sober of the Chymical Writers, doth highly extoll as an excellent Emetick in his *Ternary of Vomitive Remedies*, where he discourseth at large of the virtues of it, and the way of administering it. And of this Salt, as Chymists are pleas'd to call it, we have had out of calcin'd *Copperas* a very great quantity, and have sometimes observ'd it to have been almost as deeply colour'd as the Vitriol it self was before Calcination.

Fourthly, We several times tryed to sublime dulcified *Colcothar* with *Sal Armoniack*, in Retorts and Urinals plac'd in Sand, but whether by reason of the fixednesse of the *Colcothar*, or because the Furnace we were fain to use, though no very bad one, was none of the best, we never could that way obtain any considerable quantity of the desir'd Sublimate, and that which did ascend was but of a faint colour: wherefore, unless you have an extraordinary good Sand Furnace, if You will make use of Glass Vessels, which is the cleanliest way, You will find it expedient to sublime Your *Colcothar* in coated Retorts with an open Fire, except You have

have the Dexterity to sublime in a naked fire with Glafs Retorts uncoated, which we have divers times seen perform'd by heating the bottom of the Retort by degrees, and then placing it upon Embers, with Coals round about it, but to be kindled at a distance from it, for if this course be watchfully followed, the Retort will be so well Neal'd, before it be reduc'd to endure any intense degree of heat, that after a while You may safely lay thorowly kindled Coals, not only round about it, but upon the top of it (which needs not to be done till towards the end of the operation) and thereby drive most of the Sublimate into one Lump, and into the Neck of the Retort. And by this way You may sublime any Furnace upon a bare Hearth, but if You desire to give a more intense heat, you may lay first some warm Ashes in an ordinary Iron Pot, and having with them, and a few small Coals well kindled, Neal'd Your Retort, You may afterwards prosecute the Sublimation in the same pot, which being once thoroughly heated, it self by the Fire will afterwards considerably increase the heat of it.

Fifthly, though it be most commonly requisite to re-sublime the Sublimate that comes the first time up, that the Salt and *Colcothar* may be more exquisitely mixt, yet as far we can guesse by some tryals, it will not be expedient to resublime it above once (or at most) twice. For in those Trials we have found the *Ens Veneris* oftner resublim'd of a paler colour, than that which was resublim'd but once. And (*N.B.*) perhaps, by farther sublimations, the salt in stead of being more intimately united with the *Colcothar*, may be almost totally sever'd from it, according to what we elsewhere in other cases declare.

Sixthly, Of these Sublimates, that which hath the highest Colour seems to be the best, as being most enricht with the *Colcothar*, from whence the Rednes proceeds. But at the first sublimation I have often observ'd a pretty part of the

Sal Armoniack to come up first white by it self, especially if it had not been very diligently mix'd with the *Colcothar*. But at the second Sublimation the ingredients (which we have sometimes almost totally forc'd up without leaving a *Caput mortuum* in the bottom of the Retort) will be more accurately mixt, and the Sublimate will appear Yellow, and perhaps Reddish, of which sort we have sometimes had, when the Operation hath been carefully managed.

Seventhly, How great a proportion of the ingredients committed to Sublimation, will arise in the form of *Ens Veneris*, we dare not precisely define; but Sublimate amounting to the fourth part of the whole mixture you will scarce, if You work skilfully, fail of.

Eighthly, We sometimes made a Sublimate of equal parts of pure *Sal Armoniack* and salt of Tartar, both of them very thoroughly dried (for else they will be apt to yeild rather a Spirit than a Sublimate,) well ground together, and so sublim'd. And with this Sublimate in stead of simple *Sal Armoniack* we intended to make *Ens Veneris*, but by some intervening Accidents and Avocations we were not able to perfect the Experiment, of which we neverthelesse think it fit to give you this hint, because of the great Efficacy, which an excellent Physician of my Acquaintance, to whom I gave some of it, assures me he has found in it against Obstructions, and some Distempers that are wont to spring from them.

Ninthly, When You are about to make Your first Sublimate, You may if You please, lute to the Retort, whereinto You put the ingredients, a small Receiver to catch the liquor that oftentimes comes over. For that Liquor, though You will very seldom get much of it, yet it may be worth Your preserving, by reason of the Volatile and Urinous Salt where-with it will sometimes so abound, that it may passe for a weak Spirit of *Sal Armoniack*.

Tenthly, The *Caput Mortuum* that remains after the first

first Sublimation, may be put into a clean Glasse, and set in a Cellar, where it will run *per Deliquium*, into a thick and high colour'd Liquor, very richly impregnated (as we elsewhere manifest on another occasion) with the somewhat opened body of *Copper*, from whence if half those praises be true, w^{ch} even the best Chymists are pleas'd to give to *Copper*, it may be very well concluded to have derived no small virtues against Ulcers, and divers Affections, w^{ch} we are not here to insist on.

Eleventhly, we have sometimes doubted whether or no our *Ens Veneris* did really contain any thing of *Cypreous* or *Colcotharine* in it, partly because of the fixednes or sluggishnes of *Colcothar*, & of the *Copper* therein contain'd, & partly because that if *Sal Armoniack* be 2 or 3 times sublim'd by its self, its Flowers frequently enough will ascend yellow, like the paler sort of *ens veneris*. But first, that *sal Armoniack* is capable of carrying up even fixt & sluggish bodies seem'd probable to us, partly upon our incorporating & subliming it with finely powder'd Corals (from which, though but very little of it ascended, yet some of that little was no less red, than the Corals themselves before their being beaten) & partly upon our subliming it from *Copper*, both crude and calcin'd, since of either of those Bodies it carried up a little with it, as appear'd by the Blew colour of some parts of the Sublimates.

And Secondly, that the reddishnes of our *Ens Veneris* proceeded partly, if not altogether from the *Colcothar*, seem'd probable to us, not onely by the tast, and some other Properties of it, but also by this, that having knowingly committed the first sublimate to a fire too weak to resublime it; and having after some Hours taken the Vessel out of the Sand, we found that the Fire, which we suppos'd was not strong enough to carry up the whole Matter, had rais'd the *Sal Armoniack* to the upper part of the Urinal in Flowers, that were either White, or but pale Yellow; whereas the remaining part of the Mixture, that lay in good quantity

that were either White, or but of a pale Yellow; whereas the remaining part of the mixture, that lay in good quantity in the bottom of the Vessell, was of a deep Red, and a fragment of it of about the bignesse of a large Pease, being cast upon glowing Coals, and nimbly blown with a pair of Bellows, coloured the Flame with somewhat greenish blew like that, but more faint, which we elsewhere have observed to proceed from the well opened body of Copper:

But those Tryals, I confesse, would rather increase my Doubts, than lessen them, because in our *Ens Veneris* the Colour is not Blew, but Reddish, if I did not consider, that *Colcothar* is a body that consists of some other matter besides common Copper (as it is also far more difficult to reduce, though but in part, into a mettall, than is vulgar calcin'd Copper) and consequently when Corpuscles of differing Natures are by the *Sal Armoniack* elevated together, that which is not Metalline, may with the assistance of the Fires Operation alter the Nature of what it is, and thereby produce a Colour differing from Blew. But to dispatch what ever further Tryals shall inform us, touching this Question, whether or no any true and reducible Copper do make an Ingredient in our *Ens Veneris*, yet there being in *Colcothar* other parts as well as those, that by Fusion you may reduce into a pure Mettall, and our Remedy seeming by its Somniferous property to partake of them, it will not be necessary to the giving our Medicine a Right to the Appellation I commonly choose of *Flores Colcotharis*, that in it there is something of the *Colcothar* carried up, though possibly the quantity be but small, and not all reducible into a Metalline form: but perhaps the Question is not worth a longer Debate, it being sufficient to excuse the name, and recommend the thing to such a Person as You, that *Colcothar* is employed in the making of it, and that the thing prepared is a noble Medicine, and hath some of the great Virtues ascribed to

The Dose and
Use of *Ens Ve-*
neris.

Vitriol ; whether that Mineral be an ingredient of it, or no. The Dosis of *Ens Veneris* may be very much varied: To little Children, we give sometimes one, sometimes two, and sometimes three Grains for many nights together, as we find them able, without inconvenience, to bear the Operation. To persons of ripe Years we commonly administer four, five or six Grains at a time. But one, to whom we have given quantities of it to lie by him, tells us, That he hath taken to above thirty Grains at once without any inconvenience. We are wont to give it in two or three Spoonfuls of Sack, or other Wine, if the Constitution of the Patient, or the Nature of the Disease do not forbid it; and, in such cases, we give it in any Cordial Liquor, that is temperate, or any other convenient Vehicle.

To Children it may be given in Beer, or Ale, or clear Posset-drink, but not in Milk. If the Patient hath supped at a seasonable Hour, we commonly administer it, when he is going to sleep. It works for the most part by sweat and a little by Urine, but more by sweat at the beginning, than after the body is used to it, yet to some bodies it proves so Sudorifick, that two Grains or lesse of it, have often made me sweat. That it hath once proved Emetick I have heard, but never observed it my self to provoke Vomits.

As for the Medical use of *Ens Veneris*, divers great Physicians will perhaps think it were not despicable, though it were no other than often times to prove a safe and moderately somniferous Medicine in Feavers, without having any thing in it of *Opium*, whose Narcotick power they find as difficult to correct, as oftentimes proves dangerous, when being not well corrected, it is administered without very great Circumspection. But-*****

To the 166th, 167th, 168th, 169th, and 170th Pages.

[Finding among my loose Notes, together with those that do immediately concerne the Preparations of Sulphur and Harts-horn (delivered in these Pages) some other Particulars that may also serve, either to afford some light to Readers less skilled in Chymistry, or contribute somewhat or other towards the relief of some Patients, I am content to let those Papers go together, as I long (since addressed them to a Friend.)]

Harts-horn, *Pyrophilus*, is a Heteroclite Body in Nature, which hath but few resemblers in the Universe, for it grows to a considerable bulk like a Vegetable, and is (unlike most other horns of Animals) at certain set Periods of time, deciduous and though it be of a Bony substance, yet that middle part of it which differs from the rest in Colour, does (at least in grown Horns) much more resemble the Pith of some Plants than the Marrow of Bones: And yet this Plant-Animal (if I may so call it) does, when skillfully exposed to the Fire, afford the same differing substances, with the Blood, Flesh, and other part of Animals. It is no wonder therefore, if Physicians and Chymists have hoped to find extraordinary Virtues in so extraordinary a Subject, of which we shall passe by the Usual Preparations, as not so pertinent to our present designe, insinuating only in the general, That though even the more Vulgar Preparations, as well as that which Physitians have been pleased to call Philosophicall, afford us Medicines not despicable; yet these are much inferior to those Remedies wherewith dexterous Distillations are capable of presenting us; and certainly if we allow of the Chymicall Theory, (whose truth in these Papers I question not) Harts-horn being generally acknowledged to be endued with properties very friendly to our Nature, and

Of Hartf. horn.

even those wayes of preparing it wherein the nobler and more active parts are not truly freed from those cumbersome ones that fetter him, and hinder them to display their powerful energies, proving yet oftentimes not unavailable. The Spirit and Salt of Harts-horn would be in more request, were not Men deterred from making tryals of it, partly by the over apprehended unpleasantnesse of the smell, and partly by the difficulties commonly met with, in its Distillation; the latter of which Deterrements hath so frightened even Chymists from distilling this Cordial Substance, that we have very rarely seen any, either Spirit or Salt of Harts-horn, save what our selves have been induced to prepare.

Three wayes of
distilling
Harts-horn,

There are three wayes proposed by the Authors I have met with, to distill Harts-horn: The one in coated Glass Retorts the other in Earthen ones; and the third in *Glaubers* second Philosophical Furnace.

In the first of these wayes, some very skilful Distillers that have often practised it, have so complained of their frequent breaking their Vessels by the copiousnesse and impetuosity of the Fumes, that rush out of the Matter, when it once begins to be prest with a considerable heat, that I confesse to You ingenuously, *Pyrophilus*, they have hitherto frightened me from making tryall of that way; though I see no very great reason why, by a slow and regular gradation of the Fire, the mischances incident to this way of distillation may not (at least most commonly) be avoided.

To distill the Matter we discourse of in Earthen Retorts, is a safer way then the former, if the Earth be close and good, and have been sufficiently baked; as we find in the right *Hassian* Retorts, wherein we have known the Operation proceed very prosperously, though a considerable quantity of the Matter hath been distilled at once, but the Retorts made of Earth that is spongy or any other wayes unfit, or in whose baking Fuell hath been spared, are commonly (as Experience

perience hath informed us) improper for this service, wherein they are easily broken: Besides that, it is much to be feared that all Retorts made of Earth, except it be extraordinarily compact and baked, are apt to imbibe the more subtle and more penetrant parts of Harts-horn, and other volatile Substances distilled in them; which we have observed in some, wherein the Matter hath transudated quite through the substance of the Retort, and been manifestly discernable on the out side of it.

• The third way of distilling Harts-horn, is performed by the Instrument described by *Glauber*, in his second Philosophical Furnace: But neither is this way without its inconveniencies: for besides that, if the Earth whereof the Vessel to be employed is made, be not of very good and well-baked Earth, it will be apt to crack, in so violent a Fire as is requisite in this way of Distillation, or else it will imbibe part of the finest Spirit it should transmit into the Receiver: And besides that it is difficult to work long this way, without letting some of the active part of the Spirit escape between the wide Orifice of the Retort and the Cover: Besides these Inconveniencies, I say, it is to be feared that the Matter being to be cast immediately into the Vessel, made red hot before-hand, it will receive a stronger *Empyreuma* or impression of the Fire, than it would do in the ordinary way of Distillation, wherein the fire being orderly and successively increased, much of the Spirit and Salt comes over into the Receiver, before that last degree of Fire is administered; which is requisite chiefly to force over the more sluggish and heavy Oyle, which therefore (to speak congruously to the most received Theory of Distillation) favors much more of the Fire, and is grown almost infamous for its adustion.

But notwithstanding these Inconveniencies, *Pyrophilus*, we have found these Retorts of *Glauber's* not unserviceable, when we have had occasion to Distill considerable Quantities.

of such Materials, as were not so pretious, as to make the losse of a part of what they were to afford us, considerable.

And this Advertisement may take place, especially if you take along with you, what we have declared, touching the Wayes we substitute to avoid as much as may be, the newly objected Inconveniences. But having in other Papers taken notice particularly enough of the Wayes we mean, I shall forbear to mention them in this place, though one of them may easily be made applicable, as Experience hath assured us, even to ordinary Retorts; for it is not difficult to apply two *These*, the perforated Receivers, which being almost of the shape of Pears, open at both ends, by holes of about two or three Inches Diameter (according to the capacity of the Vessell) may be with great facility taken asunder and made clean, and may, by the convenient Insertion of their Extremities into one another, be easily luted together (in a level) two or three, or as many of them as necessity shall require: and then, provided there be applyed to the remoter extremity of the last of them, some convenient Vessell open but at one end, the Receivers will very seldom break: The fumes that come over too copiously to be contained in one of them, passing freely thence into the second or the third (for we very rarely exceed three in all) which will be manifestly cool, and so, speedily turn into Liquor, the Fumes it receives, whilst the first Recipient is perhaps hotter then the Hand can endure: But of these Mechanical Contrivances, elsewhere.

Now whereas *Glauber* prescribes to mingle with the Distill'd Liquors of Harts-horn rectified Spirit of Wine, to wash out the volatile Salt, and directs the Distilling again of both those Spirits (of Wine and Harts-horn) together: his method of proceeding may be justly questioned: For first, dephlegmed Spirit of Wine will not so readily, in the way be supposeth, dissolve the volatile Salt of Harts-horn: And next, the Spirit this way drawn is not a simple Spirit of Harts-

Animadversions
on some
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Harts-horn, but a compounded Liquor of the Spirit of Harts-horn, and that of Wine: the latter of which may possibly, in divers cases, rather impair than improve the Virtue of the former. For Spirit of Harts-horn, by reason of its opening and resolving, as well as Cordiall Virtues, is safely and successfully given in Feavers, wherein it is not observed to inflame the Blood, whereas Spirit of Wine in such cases is counted dangerous. And this brings into my thoughts a very questionable preparation of the experienced and ingenious Hartman, who much extolls, for the Worms in the Stomach, *Transl. Chym. p. 190.* Spirit of Harts-horn in generall, but especially that which he is pleased to call *Eßensificated* (that is, as himself expounds it) with which its own fixed Salt, extracted with some convenient Water, and its volatile duely depurated, have been dissolved and united. For first, The fixed Salt of Harts-horn hath been perhaps never yet prepared by any Man: and if Harts-horn doth yield a fixed Salt (as I dare not absolutely deny, but that out of many Pounds a few Grains may be extracted) it may well be doubted whether that Salt be endowed with specificall Virtues: And next, The Spirit of Harts-horn, if it be well dephlegmed, will not (for ought I could ever find) dissolve its own Salt, unlesse assisted by the External warmth of the Ambient Air: Infomuch that I usually keep the Spirit and Salt in the same Viall where they remain unmixed; and the Spirit that will dissolve any of its own Salt I account not sufficiently dephlegmed, but to have yet an Aqueous alloy, whereby the Salt is imbibed. And I remember that having once exquisitely rectified some Spirit of Harts-horn, and closed it up in a Viall, after divers months it let fall a considerable quantity of Volatile Salt, so far was it from being able, without the help of some peculiar way, to have dissolved more, had I cast more into it. I deny not that the Spirit of Harts-horn may by the mediation of heat, be brought to take in some of the Salt of the same Body: but of what use this violent

violent impregnation of the liquor can be, unlesse it be quickly administred, I do not yet understand; having often seen the Spirit let fall again in the cold, the volatile Salt it had dissolved by the assistance of heat,

A fourth way of preparations of Harts-horn used by the Author,

And having thus, *Pyrophilus*, laid before you the difficulties we have met with in the above mentioned wayes of making of Spirit of Harts-horn proposed by Authors (neither of which we would yet have you altogether reject) I must acquaint you with our having attempted a fourth way, which when the matter to be distilled is not very much, I choose rather to practise than any of the other, as hitherto seeming more safe and free from inconveniences. Take then (for instance) two pounds of Harts horn broken on an Anvil into pieces, each of about the bignesse of ones finger (for if it be rasped there is danger that it should emit its fumes too plentifully at once) and put it into a strong glass Retort uncoated, big enough to contain at least twice as much matter: Set this in Sand, and fit to it a pretty large and strong (either single or double) Receiver; then give a slow fire for three, four, or six hours, to send away first the Phlegme, and more fugitive parts of the Spirit: then encreasing the fire, but warily, and gradually for divers hours, drive over the Spirit (which is wont to drop down somewhat tinged) and the more volatile parts of the Salt; and at length intend your fire till the bottom of the Retort be glowing hot, and heap also at last quick coals upon the sand round about the Retort to give, as it were, a fire of Suppression, and so force over the more sluggish remaining parts of the Salt, and with it the Oyle: all which are to be afterwards proceeded with, according to the Directions given concerning the Spirit, Salt, and Oyle of Mans Blood: which having been sufficiently insisted on before, will not (I suppose) need to be repeated now. Only it may not be impertinent to advertise you. 1. That we have more than once had the bottom of the Retort melted, yet not broken, the melted

meted glasse being supported by the substrated sand. 2. That sometimes in Filtration, some of the thinner parts of the Oyle have unperceivedly passed through the paper with the Spirit and Salt, and have not been discovered, but by Rectification, wherein I have almost admired to see the Oyle with a gentle heat of a Lamp ascend to the top of a very tall head and body: touching which circumstance it may yet be further enquired, whether it proceed barely from the volatilenesse of the Oyle itself, or also from its being carryed up by the Salt and Spirit wherewith it was associated. 3. That by this way of distillation we usually have out of a pound of Harts-horn between four and five ounces, (seldome or never so little as four, and often nearer five) or volatile Salt, Spirit, Oyle, and Flegme; (of the last of which, if the Harts-horn be not recent, there will be no great quantity) and when he distill'd two pound of the matter at a time, we found the operation to succeed altogether as well, and to yield us a fully proportionable quantity of Lictor.

The virtues of the Spirit and Salt of Harts-horn, which differ not much in Dose, or Efficacy, are probably very great in divers distempers, wherein we have yet made no tryal of them. For they are considerable in resisting Putrefaction, comforting nature, opening Obstructions, mortifying the Acidities it meets with in the blood; and, by rendring that volatile, promoting its Circulation, we have known considerable effects of it in Feavers, Plurisies, Obstructions of the Mesentery, and Spleen; and chiefly (which perhaps you will think strange) in Coughs and Distempers of the brain, and nervous parts: in so much that I have, by Gods blessing, sometimes stopt very violent (but not inveterate Coughs) with this medicine in a few hours. And prescribing it to one who was almost daily assaulted with Epileptical fits, a few Doses of it did in a pretty while at first make his fits come but seldome, and after, not at all: But whether he be perfectly cured not ha-

The Use and
Effects of the
Spirit of Salt of
Harts-horn, and
the Dose of it.

ving heard of him of late, nor having had opportunity to make further tryal of the Medicine in that disease, I am not certain. We prescribed it likewise, not long since, to a Person who had long laine both distracted, and almost bed-rid, and was in a short time strangely relieved by the use of it, though not perfectly cured (perhaps because the Patient took but little of the medicine, we being then not well stored with it;) and on some that have been by Feavers rendred stupid, it hath had very eminent Operations: but for a further account of its virtues, I must referre you to the particular Narratives, I may, when we meet, give you by word of mouth: and till then it may suffice to tell you that it works chiefly by Sweat (and somewhat by Urine) without being observed to leave behind it such heat as divers Sudorificks are wont to do: only there must be care not to administer it when the *Prima vie*, and passages are too much stuffed and choaked up by grosse Humours, lest by agitating the blood, and putting it into a nimble Motion, it occasion greater Obstructions. The Dose is from five drops, or grains, to a drachme (ten or fifteen drops are wont to make me sweat) in Wine, *Cardus Benedictus* water, or any vehicle appropriated to the disease; only taking care that nothing acid be administred with it, because Acid and Sulphureous Salts mortifie, and disarm one another. *Hartman* commends it against the worms of the stomach, against which it may very propably be available, by reason of its penetrant, and saline nature, and its emnity to Putrefaction: *Glauber* writes, that the Oyle rectified from Salt of Tartar, cures Quartans, and inward wounds, and cures the pains produced by Falls, Convulsions, &c. being administred from six to twenty drops to a Patient placed in his bed to sweat after it: but of this, my Experience will not enable me to say any thing. And I fear, *Pyrophilus*, that I have already too long entertained you about Harts-horn: and yet I fear too, that you expect that, before I forsake this Subject, I should say

say something to you concerning a much controverted particular relating thereunto. The Inquiry is, Whether or no, when it is distilled, the Salt dispose it self in the Receiver into the figures of Harts-horn, the Affirmative is maintained by many Chymists, and a friend of mine who is very severe, and not at all credulous, having assured me that he himself had observed the inside of his Receiver overlaid with such figures or horns, I dare not deny, but that accidentally the particles of the volatile Salt may sometimes represent as well the shape of Harts-horns, as of divers other things. But for our parts, having several wayes, and not unfrequently distilled that matter, we could never see the pretended Saline Harts-horns, so clearly as we thought we saw cause to esteem that those who affirm'd they constantly saw them so distinctly lookt through the spectacles of prepossest Imagination: not to mention, that it is the usuall method of nature in Salts to make the bigger Concretions of the same figures with the smaller grains, as we observe in Nitre, Rock-allum, &c. And the grains of the Salt of Harts-horn, though I have attentively enough considered their shapes, I remember not ever to have observed of a figure like that of the horns they came from: but it is the nature of volatile Salts to fasten themselves to the Receiver in various figures according as the degree of fire that urges them up, and other concurrent circumstances do chance to exact; and consonantly hereunto we have often observed the volatile Salt of the same Harts-horn to be very variously figured in the same Receiver: and I remember that not long since subliming some volatile Salt of Urine, it adher'd to the upper part of the vessell in figures, much liker Harts-horns, than ever I had seen their volatile Salt make up: so that unlesse we will merrily say, that the man whose urine was distill'd, had horns given him by his wife, we must acknowledge that nature seems to give her self liberty to play in the Configuration of

Q. Whether in the distillation of Harts-horn, the Salt dispose it self into the Figure of the Horn.

volatile Salts, and that casualties have no unusual influence on them ; or , to speak more properly, that the various degrees of Fire, the differing copiousness of the Fumes, and many other intervening accidents do keep those Configurations from being constantly regular : and I remember that a while since, filtering through Cap-paper a Tincture of glass of Antimony, made with Spirit of Vinegar and Spirit of Wine, almost according to *Bassilius* : the matter which remained in the paper (which was placed in a glass funnel, and was of the same shape) did of it self, when it began to grow dry , cleave into the figures of trees , whose trunks , greater boughs , and smaller branches, were both for there shape, and proportion, as lively represented as if they had been drawn by the curious penfill of some skilful Painter ; which paper I shewed to some persons that beheld it not without wonder, and for ought I know I am yet able to shew it you : nor is this the only Instance I could give you if need were , if I had not trifled too long already to manifest at present, that now and then, Chance may make Nature seem to emulate Art.

That Bucks-horns may be substituted for Stags-horns.

But as long as I have dwelt, *Pyrophilus*, on this Subject, before I passe to another ; I must not forget to advertise you, that in case Stags-Horns cannot be procured for the preparation of the above-mention'd Remedies , you may without much disadvantage substitute Bucks-horns in their stead : for almost all the tryals we have had opportunity to make of the Medicines we have been lately discoursing of, have been made with Remedies , whereto Bucks-horns afforded Materials.

How to keep the Spirit and Salt of Harts-horn.

I had almost forgot, *Pyrophilus*, to tell you, That to keep the rectified Spirit of Harts-horn, Blood, or the like, is more uneasy, than any thing but trial would make one think ; and yet to keep the Volatile Salt is more difficult , than to preserve the Spirit : for more than once, when I have kept these fugitive animal-Salts by themselves, they have penetrated the

Corks,

Corks, and scarce left me in the well stopped Glasses any foot-
 steps of their having been there, and therefore those Chy-
 mists that are not strangers to these Salts, have taken much
 pains to no great purpose to keep them from Avolation, some
 of the recentest and ingeniousest are wont, that they may mo-
 derate their uncurbed wildnesse, to pour on them as much of
 some such Acid Spirit, as that of Salt of Vitriol, &c. as will
 produce any manifest conflict with the Volatile Salt, never
 considering, that as this course doth indeed devest them of
 their fugacity, so it doth in effect devest them of a great part of
 their Nature, and consequently of their peculiar Virtues. For I
 have elsewhere shewn, that the Saline Corpuscles, obtainable
 by the Fire from Urine, being united with a sufficient propor-
 tion of Spirit of Salt, will cease to be what they were, and with
 the Saline parts of the Acid Liquor, will make up a kind of
Sal. Armoniack. But it is easier for me in this our case to shew
 that another mans Expedient is not good, then to substitute
 a good one; especially in this place, where for some Reasons
 I must not set down the way that I the best approve of: only
 I shall tell You, that my way long was (nor do I yet despise it)
 to preserve volatile Salts in their own rectified Spirit, which
 swimming over them, kept them from the immediate contact
 of the Air, and preserved them so well, that by this means I
 have secured even small parcels of the fugitive Salt, of humane
 Blood for many Years.

[But since the Spirit and Salt even of this sort of Horns, will
 not, I fear, be found so easie for every Man, especially, if he be a
 Novice in Chymistry to procure in any considerable Quantity, &
 since the declared intent of my communicating to the Reader my
 Observations about these Spirits of Harts-horn, Blood, &c. was
 to furnish him with such Chymical Remedies, that men may by
 their easinesse and cheapnesse be invited to provide them for the
 use of the Poor; I presume it will not be improper to present

him with a succedaneum or two, that may be easily enough obtain'd from Sal-Armoniack, though these Preparations have such Connexion with divers other Passages, wherewith they were Written to the Person I here call Pyrophilus, that, to avoid the too much dismembring those Papers, and to make these Processes the better understood, I must content my self to leave out those Particulars that can best be spared, hoping that the rest will be easily excused, at least by those who know how much some Chymists themselves have been deluded in their Trials of the divulged Processes, divers of which are either false or very uncertain, and others, though they should succeed, would give but a philosophical spirit, much of the obtained Liquor coming from the Distillable Concretes that must according to such Processes be mingled with the Sal-Armoniack, of which I could easily give instances, even out of modern and applauded Writers.]

Of the Spirit of
Sal-Armoniack,
and divers attempts
& wayes
of preparing it.

The Spirit of Sal-Armoniack, Pyrophilus, hath such wonders ascribed to it by Chymists, that, if I should conclude these Papers touching Spirits of an Urinous nature, without saying something to you of that, you might think I had left the considerablest of them unmentioned; but as I the rather acquaint you with the little I know of it, because, though I have met with divers Authors that extoll it, I have scarce met with any that teaches intelligibly, and candidly how to prepare it, which perhaps most of them did not know themselves, so I hope you will exact an accurate account of it the lesse rigidly, because I can present to you but little on that Subject, besides the few Observations wherewith my own Curiosity has supplied me: having scarce ever (to my knowledge) seen any Spirit of Sal-Armoniack save what my own Furnaces have afforded me, and therefore without presuming to set down solemn processes about a subject, wherein I have found a small variation of Circumstances hinder the operations made on it from producing uniform effects, I shall content

cont

lent my self to give you as true an information as my memory will afford me of a few of my proceedings with this nice Salt, and the successes of them: only premising in a Word, that by *Sal-Armoniack* I here mean the Factitious and Venal, consisting of Urine, Soot, and Sea-salt.

And first, according to the way proposed by *Glauber* (in the second part of his Philosophicall Furnaces) we distilled it out of an open Retort (with a Cover to clap on and take off as occasion requires) with a mixture of *Lapis Calaminaris*; and once we, that way, obtained a quantity of Liquor, which seemed exceeding strong, but before we could make any tryals with it, the Vial that contained it having been accidentally broken, we lost the opportunity of satisfying our selves of the efficacy of it: and having not long since attempted to make such a Spirit the same way, there came over indeed a Liquor which seemed to be the Spirit of *Sal-Armoniack*; but when we came to Rectifie it in a gentle heat, the greater part of it to our wonder, coagulated in the Retort, whereinto it was put to be distilled, into a perfect *Sal-Armoniack*, (a pretty quantity of which I yet keep by me) and thereby betrayed the above-mentioned Liquor to have been little else then the *Sal-Armoniack* it self, forced over by the violence of the Fire, without having suffered any separation of its Ingredients. Nor is it by us alone, that the Proesse set down by *Glauber*, hath been unprosperously attempted, and yet perhaps it might have constantly enough succeeded with him, and the difference of the *Lapis Calaminaris* (in which we have observed much disparity according to the places it comes from) may have produced the complained of variety of Successes.

We also attempted to distill a Spirit from *Sal-Armoniack* (to pretermitt divers other tryals) by mixing it with equall parts of Salt of *Tartar*; but in this experiment we met with variety of successe, for having exquisitely incorporated the two Salts by the help of a little fair Water, we have divers times

times had the upper part of the receiver (carefully luted on to a somewhat large retort) all candied over on the inside, with Volatile Salts of severall shapes; and the Liquor afterwards forced over, hath sometimes remained long enough in the form of a very subtile and penetrant Spirit, and sometimes again, it hath in the very receiver almost totally coagulated it self into a lump of Chry stalline Salt: and when we had mixt the Salt of *Tartar*, and *Sal-Armoniack*, without any Water or other moisture at all, our successes have been very like those above mentioned. Upon this occasion I dare not omit acquainting you with an Experiment, which yet I learnt not upon this occasion. Take of pure Salt of *Tartar*, and of good *Sal-Armoniack*, equall parts (let them be both very dry, or else you may loose your labour) and grind them very accurately together, though you be deterred from continuing that toyle, by a very subtile and fetid Urinous steam, wont to exhale from the mixture; these Salts being thus exquisitely incorporated, you must put them into a large Glasse Retort, to which you may fit a Receiver to catch a fetid Liquor that sometimes we have observed to come over; then administering by degrees a very strong Fire, the top and Neck of the Retort, will be lined with a pure white Sublimate, which seems to partake as well (though nothing neer so much) of the Salt of *Tartar*, as of the *Sal-Armoniack* and of its Qualities, and yet to differ from either: and though this Sublimate be farre enough from being the true Volatile Salt of *Tartar* so highly extolled by *Paracelsus* and *Helmont*; yet it is no ignoble Medicine in obstructions, and some other distempers: And I remember one of the most expert Chymists I know, having made tryal of some I presented him, told me he found such effects of it, as made him divers times very pressing and solicitous for more. The Fetid Liquor that will come over we have found sometimes to be very little, and at other times much more copious, without being able to discern clearly

clearly whence the disparity proceeded; and the *Caput Mor-*
tuum remaining in the Retort, by Solution, Filtration, and
 Coagulation, affords a pure Salt of greater Diuretical effica-
 cy, than almost any I have hitherto met withall: Another
 way by which we attempted to attain a Spirit of *Sal. Armo-*
niac, was, by accurately mixing two parts of it, with three
 or four of Quick-lime, whose virtue had not been impaired by
 being exposed to the Air. This mixture being distilled in a
 Retort, placed in sand, with a strong fire afforded us (toge-
 ther with some dry sublimate in the neck of the Retort, and, as
 I remember, a little volatile Salt in the Receiver) in a very
 strong and yellowish Spirit, so exceedingly penetrant, and
 stinking, that it was not easie to hold ones nose to the open
 mouth of the Vial wherein it was kept, without danger of
 being struck down, or for a while disabled to take breath, by
 the plenty and violence of the exhaling Spirits: But the Liquor
 forced over by this method, though exceeding vigorous as to
 its Qualities, was inconsiderable, as to its Quantity; and there-
 fore we now chuse to vary a little this way of proceeding, and
 let the Quick-lime lie abroad in the open Air (but pro-
 tected from all other moisture, except that of the Air) for
 divers dayes; in which time the imbib'd humidity of the am-
 bient Air would in some degrees slake it, and make it some-
 what britler than it was before; and the Lime thus prepared,
 being mingled with Salt-Armoniack, and distilled in all cir-
 cumstances after the former manner, afforded us a Liquor so
 copious, and yet so strong, that we hitherto acquiesce in this
 way of distilling this wild Salt, as the best we have yet met
 with. But note, that we used, towards the latter end, to en-
 crease the fire to that degree, by heaping up Coals on the up-
 per part of the Retort, that the Mixture in the Retort hath
 been brought to flow. Note also, that though even the Spirit
 thus drawn persevered long in the form of a Liquor, yet
 yesterday coming to look upon a Vial of it, which we
 reserved,

reserved, to try what effect time would have on it, we found that about a fourth or fifth part of it had spontaneously coagulated it self into exactly figured grains of a Chrystalline Salt, the Liquor swimming about it, retaining, nevertheless, a very strange subtlety: Which observation concurring with divers others makes me apt to doubt, whether or no this so celebrated Spirit of Salt-Armoniack be really much, if at all, other then the resolved Salt of Urine, and Soor, of which that body consists, somewhat subtiliated by the fire, and freed from the clogging Society of the Sea-salt, to which they were formerly associated and united; though I confesse it seemeth not improbable, by the great Energy which may be observed in this Spirit, when it is dextrously drawn, that the entire Concrete, and the Quick-lime, may afford it something that it could not receive from either of the Ingredients, whence the Mixture did result, as we see in *Aqua Regis*, which dissolves crude gold, though neither the Salt-Armoniack, nor the Peter, nor the Vitriol alone affords, by the usual wayes, Spirit capable of producing that effect. The great virtues, and uses of Salt-Armoniack, especially in Physick, I cannot now stay to treat of, but you will find them largely enough set down by *Glauber*; whose Encomiums nevertheless, must not be all adopted by me, who in this place mention the Spirit of Sal-Armoniack, but as a Medicine that is near of kin, and may serve for a *Succedaneum* to the Spirits of Harts-horn, Urine, Blood, &c.

But although the last mentioned way, *Pyrophilus*, be the least imperfect one we have hitherto met with, of distilling Salt-Armoniack, yet because you may sometimes need a Spirituous liquor impregnated with the activest parts of that noble concrete when you want either Retorts to distill in, or Furnaces capable of giving strong fires, I dare not omit to inform you, that, we have sometimes drawn over such a liquor of Salt-Armoniack after the following manner. Dissolve pure

Salt-

Salt-Armoniack in a small quantity of fair water, then in a
 Cucurbit put such a quantity of strong Quick-lime powder'd,
 as may fill up a fifth or sixth part of the vessel, and water it
 very well by degrees with the former Solution of the Salt-
 Armoniack, & immediately clap an Alembick on the Concur-
 bit, and fasten a Receiver to the Alembick, closing the joynts
 very accurately; and from this mixture, by the gentle heat of a
 Bath or a Lamp, you may obtain a Liquor that smells much
 like Spirit of Urine, and seems to be much of the same na-
 ture; and this volatile Liquor being once or twice rectified
per se, with a very mild heat, grows exceeding fugitive and
 penetrant, and works by Sweat, and a little, perhaps, by
 Urine; and I remember that when I first made it, having been
 induced by some Analogicall Experiments, I had formerly
 made, to give it to one that had a Patient troubled with an ex-
 tremely violent Cough, I had an account quickly brought me,
 that he not slowly, but wonderfully mended upon the very
 first or second Dose; and indeed the tryals that have hitherto
 been made of it, makes me hope that it will prove little Inferi-
 or in efficacy to the other above mentioned more costly
 Spirits, scarce any of which being preparable by so safe, and
 compendious a way, if this Medicine emulate them in Virtue,
 the easinesse of the preparation (wherein little time needs be
 spent, and lesse danger or breaking vessels incurr'd) will much
 endear it to me. But, *Pyrophilus*, because I would assist You to
 make variety of Experiments about Volatile Salts, and because
 divers tryals may be more conveniently made, when the Sa-
 line Corpuscles are in a dry form, then when they are in that
 of a Liquor; I will take this occasion to mention to You a
 way by whose Intervention a change on the fixt body em-
 ployed about the newly mentioned Experiment, hath some-
 times afforded me store of volatile Salt. This way was only to
 mingle exquisitely a quantity of Sal-Armoniack, with about
 thrice its weight of strong Wood-ashes. For the Spirit that

we this way draw out of a Retort plac'd in Sand, did quickly in the Receiver Coagulate into a Salt; and this method was again experimented with like successe. And the Salt thus made, we found so extremely subtle and volatile, that it seem'd to be much of the same nature with that of Urine; and if it be indeed (as probably it is) onely the Volatile Salt of the Urine, and perhaps also of the Soot, whereof the *Sal Armoniack* consists, this may passe for a more compendious way of obtaining such Salts, than others that are hitherto wont to be practis'd among Chymists. But I will not undertake that this way of obtaining rather Salt than Spirit shall constantly succeed. Yet if you find it do not, I shall not perchance refuse You a better way. But if you could devise a Method (which possibly is not unattainable) of bringing over into a Spirit not the bare Urinous and fuliginous Ingredients of *Sal Armoniack* but the whole Body; it may be, you would have a *Menstruum* that would make good, if not surpasse even *Renanus's*, and *Glauber's* Elogies of the Spirit of *Sal Armoniack*.

Of preparations
of Saline and
Sulphureous
Fetid Liquors.

The affinity betwixt Volatile Salts and Sulphurs, doth, *Pyrophilus*, as well as your Curiosity, invite me to acquaint you with some of the Tryals we have made about the Preparation of Sulphureous Fetid Liquors, which I am the more inclined to do, because, though I find mention made of some of them in Chymical Books, yet they are there delivered with so little encouragement, amongst many other processes of which it appears not that the prescribers made trial, that when I had distilled some of those Sulphurs, divers expert Chymists were very desirous to have a sight of them to satisfy themselves that such Liquors could be so prepar'd. The way of making the common Balsam, or Ruby of Sulphur, is too well known to need to be long insisted on. Only, because there is some little variety used by several in the preparation, it will not perhaps be amiss to inform you that we

are

we went to make it by mixing about three parts of Oyl of Turpentine, with two of good flower of Brimstone, and setting them on a strong Urinal slightly stop'd in an heat of Sand, only great enough to make the Liquor with a little crackling noise (whencesoever that proceeds) work upon the *Sulphur*, till it be all perfectly resolv'd into a Blood-red Balsam which will be performed in six, eight, or ten Hours, according to the quantity of the Ingredients to be united; this Balsam, which is indeed in some cases no despicable remedy, is by vulgar Chymists, according to their custome, very highly extolled, and sometimes employed in Distempers and Constitutions, wherein, instead of performing the wonders by them expected, its Heat doth more harme, than its drying and Balsamick properties do good: but yet apparent it will be, by what we shall say anon, that by this preparation, the Body of the *Sulphur* is somewhat opened, and therefore (as we said) in some cases the Ruby of *Sulphur* may prove no ineffectual Remedy, which may probably be improved if it be prepared by bare Digestion in a very gentle heat, by which course we have prosperously prepared it, though not in so short a time, when we made it not in order to some other Medicine.

To Volatilize the *Sulphur* thus resolv'd we took the Balsam made the former way in a few Houres, and putting it in a Retort, either with, or without fair Water, which is supposed to help to carry up the superfluous Oyl, we placed the Vessel in a Sand-Furnace; and, with a gentle heat drawing off as much of the Oyl of Turpentine as would in that heat come over, we shifted the Receiver, and carefully lured on the new one; and lastly, giving Fire by degrees, we forced over a Liquor of a deep and darkish Red, extremely penetrant, but of a smell so sulphureous and diffusive of it self, that it was scarce to be restrained by Corkes, and was by great oddes stronger than that of the Ruby before distillation.

To Volatilize
the Balsam of
Sulphur.

The like Experiment we tried in a Glasse-head and body placed

placed in Sand, and through that way, likewise we obtained a Volatile Balsam of *Sulphur*, yet we found it too inconvenient to be equallable with the former. What long Digestions of this Liquor will do, to take away, or lessen its Empyreumatical and offensive Odour, we have not yet been by experience satisfied, no more than of its medical Virtues; though probably, the great penetrancy of the Liquor considered, they will not be languid.

Authors also prescribe the making a volatile Balsam of *Sulphur*, by driving over, after the above-mentioned manner, a Solution of Flower of Brimstone in Linseed Oyle, and this Remedy they highly extoll; but though it may probably prove a good Medicine, yet since they commend it but by conjecture, and not upon experience, I see no great reason why it should be preferable to the other; for we find that expressed Oyles are much more apt to receive an offensive *Empyreuma* than Oyle of Turpentine, which being much more volatile than they, requires nothing near so violent a heat to make it ascend; and, unlesse it be found that the Sulphureous particles are able to mitigate the corrosive ones, the distilled Liquor of an expressed Oyle may prove noxious in the Body, For by purposely (for tryals sake) distilling Oyle Olive, by it self, though not in a naked Fire, we obtained a Liquor of that exceeding sharpness, that it would (taken inwardly) probably corrode, or fret either the Stomach or some other of the internal Parts.

There is another way of preparing a Sulphureous Balsam, to which *Penotus* no ignoble Chymist, ascribes such stupendious virtues, that though I have not yet made tryal of it in Diseases, yet I dare not leave it altogether unmentioned; the process being briefly but this. Take good Balsam of *Sulphur* made with Spirit or Oyle of Turpentine, and having freed it from its superfluous Oyliness, pour on it well dephlegm'd Spirit of Wine, and therewith draw by affusion of new Spirit as often

Penotus his Preparation of a Sulphureous Balsam with the Authors Advertisements upon it.

often as need requires a sufficient quantity of a Red Tincture, which by filtration and abstraction *in Balneo* must be reduced to a Balsamick consistence; this Liquor you may if you please by degrees of Fire drive through a Retort placed in Sand, and thereby obtain a volatile Balsam of very great penetrancy, and probably of no small efficacy; but the Trial I have made of this proceſſe, gives me occasion to advertise You;

1. That, unless your Balsam be reduced to a stiff thick-ness, and almost to dryness it self, the Operation will hardly succeed, we having fruitlessly digested for some months Spirit of Wine upon Balsam, whose consistence was somewhat too Liquid.

2. That as soon as the Spirit of Wine is sufficiently tinted, it ought to be Decanted, and succeeded by new; lest by too long digestion, instead of heightning its Tincture, it let fall that which it hath already acquired.

3. That upon a very slow abstraction of most of the Tinted Spirit in a digesting furnace, we once found the remaining Liquor not to be in the form of a Balsam, but to consist partly of Spirit of Wine; and partly of a seeming distinct Oyle, whereinto the Sulphureous Tincture was reduced. The Balsam of *Sulphur* thus made without Distillation seems likely to be an innocenter and nobler Medicine than the common Ruby of *Sulphur*, made with a hot and ill scented Oyle of Turpentine: and by this preparation may also appear the truth of what we formerly said, when we told you, that the body of the Sulphur was opened by Solution in Oleaginous Liquors: for out of the common thickened Balsam, as you may be informed by this process, well Rectified Spirit of Wine will, in a short time, extract a blood red Tincture, whereas by long digestion of Spirit of Wine alone upon pure, but undissolved, flowers of Brimstone, we could not discern any change of colour in the *Menstruum*; though I dare not deny the

the possibility of what some Authors affirm, who write, that Spirit of wine very excellently Dephlegm'd, will in time, of it self, draw a Tincture from flowers of *Sulphur*, which Tincture they yet pretend not to make of a higher then a Lemmon colour. And, by the way, let me tell you, that our red tincture formerly mentioned is (if it be well made) so strong of the *Sulphur*, that probably it would make a very penetrant, and effectual outward remedy in Aches, and divers other cold distempers of the nervous parts; for it hath been already found, that good Spirit of Wine alone is one of the powerfulllest Fomentations in divers cases of that nature; (inso-much that it hath been sometimes found to arrest the spreading Mortification of Gangrenes;) and therefore being so richly impregnated with *Sulphur*, which is, even without the assistance of so subtle a vehicle, very available in many disaffections of the *Genus Nervosum*, 'tis probable that the skillful association of two such active remedies may produce considerable Effects.

Of an Excellent Balsam of Sulphur made only with Oyle of Olive.
The common way of preparing it.

Take of pure flowers of *Sulphur* one part, of the best Oyle Olive four or five parts, mix them well together in a strong earthen pot, able to contain a much greater quantity of the ingredients than is to be put in it; set this vessel over a moderate fire of Charcoals, thoroughly kindled, till the Oyle, though slowly, have perfectly dissolved all the Flowers of *Sulphur*, which will (if you work it well) be performed in about half an hour, or an hour (according to the quantity of your Materials;) But you must have a great care, during the whole Operation, first, that the Oyle catch not fire, whereby it would not only be lost it self, but perhaps endanger the firing of the house; and next, that the Mixture be kept nimbly, and constantly stirring from the first beginning of the Oyles action on the *Sulphur*, till the Solution be fully made; and the

Por

Pot (having been taken off the fire) be grown cold again. The chief signs whereby you may perceive, that you have not erred in the Operations, are, *First*, if the *Sulphur* be perfectly dissolved in the Oyl, which you must often try before you take it from the fire, by taking up with the tip of a stick a drop or two of the Liquor yet in Preparation, and letting it cool on white Paper, or on your Nail, whereby you may discern, when the Solution is perfectly made, by the deep Rednesse, and Transparency of the Liquor, and by its containing no more in it any undissolved Flowers of the Brimstone; *Next*, by the Consistency of the Balsam, which ought to be neither too Liquid (as you will find it, if it hath not staid its due time on the fire; nor too thick (as it is apt to become, if you remove it not seasonably from the fire,) but of the consistence of somewhat thin Honey; and *lastly*, by the smell, which ought to be strong of the *Sulphur*, but not of the fire; for though the Sulphureous Stink is, in this Remedy, to be expected, that Empyreumatical one, which proceeds from burning (and by skilful nostrils may be easily discerned) is very possible to be avoided.

The *Dosis* of this Balsam, when it is to be inwardly used, may be from two to fifteen, or twenty drops, according as the greatnesse of the distemper, and chiefly the strength, and Constitution of the Patient shall require and bear. It may be given upon a fasting Stomach, either alone, or brought to the Consistence of Pills, or of a *Bolus* with powdered Sugar, Liquorice, &c. or else dissolved in any convenient Vehicle, wherewith its Oleaginous nature will permit it to mingle. Outwardly it may be administred either by bare inunction of the part affected, or else by incorporating it with any other convenient Oyntment, or Playster: after which, we are wont to prescribe to have an application made to the part of two or three litle Bags filled with Sand, as warm as the Patient can easily endure it, and shifted as soon as either of them begins

to cool, that by this means, the Pores being opened, the Vertue of the Balsam, by being made more penetrant, may reach the farther.

I have been thus particular, *Pyrophilus*, in the mention of this Remedy, because though it seem but a slight and trivial Preparation, yet Experience hath given us better opinion of it, then I fear the slightnesse of the Preparation will as yet allow You. And indeed its Vertues, I am apt to think more than I have yet had occasion to observe, and therefore must refer you to *Rulandus* his Centuries, where they are often mentioned: but outwardly in Strains, old Aches, Bruises, and the like, it is wont to be very effectual; in the beginning of Fits of the Gout it hath several times (though not constantly) been prosperously applied both to Mr. B. B. and divers other persons, and sometimes it hath been found not ineffectual even in the *Sciatica* it self. And as for Paralytical distempers, I have had by a skilful Physitian an account sent me of scarce credible things which it hath therein performed: to which I shall onely adde, that a while since, I had great thanks returned me on the behalf of a fair young Lady, to whom I prosperously prescribed it against a great Tumor in her neck, which was supposed to be the beginning of the Kings-evil: But this Tumor was recent enough, which circumstance I think fit to specify, because I fear that if the Scrophulous Tumor had been inveterate, the successe would not have been so good. Inwardly the chief Use we made of it hath been in Coughs, and Distempers allyed thereunto: But its Balsamical nature, making it both healing and resistive (if I may so speak) of Putrefaction, makes it probable that its Vertues may be more extensive; to which purpose I remember that a while since a friend of mine tried it with wonderful success in *mittu sanguinis ferè deplorato*, having first by a gentle heat reduced it to such a Consistence, as allowed him to make it up into Pills. But of the particular

Cases

Cases, wherein our Remedy hath been succesful, no more at present, We shall rather subjoyn, That though this have been the way which we have the ofteneft employed in the making of the Balsam; yet we must not conceal from You, that we have divers times met with Accidents, which frustrated our endeavours and expectations. For if the fire administred be too languid, the Solution of the *Sulphur* by the oyl proceeds not well: and on the other side have found, that not only a strong heat is apt to burn the matter, or to make the Oyl boyl over, and perhaps take fire; but even that upon a very litle excessive in the degree of heat, the Oyle and *Sulphur* would, before it could be expected, degenerate together into a heavy and viscous Lump (almost of the colour of the liver of an Animal) which coagulated matter proved afterwards exceeding difficult to be by the affusion of fresh Oyl dissolved and reduced to a due consistence. Wherefore we tryed to prepare this Balsam by putting the proportion of Ingredients formerly mentioned into a strong Urinal, which we placed in Sand, and making under it no more fire then was sufficient to make it slowly work upon the Flowers, (which did often during their Solution make a crackling noise,) we continued the Operation for divers (perhaps many) hours, at the end of which we found the *Sulphur* dissolved, and the mixture reduced to a Balsamick colour and consistence. So that if you distrust your dexterity to prepare this Balsam by the former way with a naked fire, we must advise you to make use of this latter way, as that which is the safer, though it be the longer way of proceeding. Nay when we had leisure enough, we did, for tryals sake, prosperously attempt the Solution of Flowers of Brimstone, with common Oyl by the far gentler heat of bare Digestion, and by that means obtained a Balsam perfectly free from adustion, but of somewhat too liquid a consistence, which may be easily remedied by the mixture of powdered Liquorice, Sugar, or any other such convenient Concrete. We

Other wayes of
preparing this
Balsam.

must also advertise you that this Balsam may also be prepared with oyl of Nuts, of Poppy seeds, of *Hypericon*, instead of Oyl Olive, or any other exprest Oyl, appropriated to the particular distemper against which the Physician intends to employ the remedy: onely care must be had that the Specifick qualities of the Oyl be not so fugitive, as to be destroyed by the Ebullition requisite to the making of the Balsam; which if it be to be enriched with specifick virtues in relation to any particular disease, may perhaps be best prepared by the last mentioned way (of digestion) wherein the subtle Spirits that impregnate the Oyl are not in such danger to be dissipated by the Fire.

A Balsam of
Antimony.

The knowing Chymists themselves (*Pyrophilus*) are wont so much (and perhaps not altogether undeservedly) to extoll the efficacy of Antimony, that we were thereby invited, besides divers Preparations of it for internal use, to attempt the making of some remedies of it, that might also be externally applicable; and in prosecution of this design, we found that by boyling four or five fingers height of good Oyl of Turpentine upon very finely powdered Antimony, put with the Liquor into a strong Glasse-Urinal, placed in Sand, the Oyl after some hours would grow exceeding high Tincted; and being gently in great part abstracted, would leave behind it a body of a Balsamick consistence, and a deep rednesse: which may, I presume, be applied to resolve, and discusse hard Tumours, and remedy divers other outward Evils, with more effect than the simple Balsam of common *Sulphur* formerly described. And from this Antimonial Balsam abstracted to a stiffer consistence, we found, that Spirit of Wine would draw a Tincture, which I likewise suppose might prove a very powerful Fomentation; though the Spirit we used (perhaps because it was not sufficiently dephlegmated) did not in a few dayes attain to more than a very pale rednesse: but this Tincture being slowly freed from the most

part

part of the Spirit of Wine, became of the consistence of somewhat liquid Honey, and of a deeper colour, thereby affording us a purer Balsam: which we have not yet, (being hindred by some accidents) attempted to bring over the Helm. Nor did we here desist, but by divers Tryals found that the Antimonial Balsam, above mentioned, being put into a Retort, placed in Sand, and pressed by degrees of fire, would at length emit Streams, which would condense in the neck of the Retort, and fall thence into the Receiver in sanguine drops: this volatile red Balsam (especially if by this volatilization the Antimony have lost its Emetick property) we cannot but think endowed with more than ordinary Virtues, outward and perhaps inward too: considering the great penetrancy of the Liquor, and the energy of the Mineral, with whose subtle parts it is richly impregnated, if it consist not mainly of them. But we are yet in prosecution of this Preparation, and therefore till we have seen how far we are like to improve this Remedy, we shall forbear any farther mention of it, especially since we have already in this very Paper, given you as we suppose, sufficient proof, that we are more solicitous for your Satisfaction and proficiency, than for our own Reputation, (of being a severe Critick in estimating of Medicines) For otherwise we should not have been so indiscreet, as to acquaint you with any Preparation, of whose medical Virtues we have not yet made much tryal, whilst we are not destitute of other remedies, whose efficacy hath been manifested to us by Experience. But we have often observed, that divers useful Chymical Preparations are mentioned so obscurely, & unintelligibly by the Authors that write of them, or else are without any particular, or encouraging note of distinction mentioned amongst a crowd of other Processes, some of which have perhaps already been found to be false, or trivial, and others of which may be rationally enough distrusted, that most Physicians, and Chymists themselves are deterred from attempting

Of the obscure
and cryptical
way of writing
of Chymists,

to prepare those remedies, not so much because they seem unlikely to prove considerable, as because they are afraid that the Processes are false, or fraudulently set down, and consequently, that Concretes of such a Consistence, Colour, Scent, and other obvvious Qualities, as are ascribed to the Remedies proposed, are not preparable by the publisht Directions.

- And that you might see, *Pyrophilus*, what discouragements I have met with even from Artists themselves to keep me from trusting to Printed Chymical processes, I think it not amisse to mention here a memorable passage of the famous, and experienced *Alexander Van Suchien*, who is reported to have gotten more by the practice of Chymical Physick then any of the Contemporary Professors of it: for he, towards the end of his Book of the secrets of Antimony (of which he clearly discloseth not any in that Treatise) gives this account of his Cryptical way of writing; *Quod in hoc Tractatu nullum Recipe proposuerim, ob id factum est, quod vos seducere volo; Recipe enim illa seducunt juniores Medicos: sed neque à Theophrasto ullum Recipe scriptum est, quod ad Medicinam, quin occultum sensum habeat, & in quo nihil vel deerit, vel abundet, & hoc non fit sine magnis causis.* Wherefore I make account, that, besides that such changes of the qualities of Bodies may afford much light to Naturalists, he doth Chymists no uselesse piece of service, that acquaints them with the successe of the nobler sort of Processes mentioned in Authors, though he should give them litle or no account of the Virtues of the Remedies prepared by those Processes: but this I hope is not altogether our case; for besides that our Observations are likely to save You much Trouble, and perhaps some mistakes, and misadventures: besides that, (I say) we have had opportunity to observe such eminent effects of several of the volatile Liquors described in these Papers, as may justly give us promising Expectations of the properties of the rest, which are in their obvvious qualities so neer of kin to them.

And

And this sort of Medicines having been found sometimes to do wonders, and generally to be safe (which of a few of the known operative, and not Specifick Medicines can be truly affirmed) I am apt to think, that he that shall bring these Remedies, in spite of their ill scent, into the good opinion of Physicians may make no inconsiderable number of Patients beholden to him.

I should not, *Pyrophilus*, proceed to make You repent your Curiosity to know my thoughts of the Urinous, and Sulphureous Remedies it hath hitherto made me treat of; were it not that there yet remains something to be said, without which, all that hath been said, will scarce signifie very much towards the effectual recommending of those Medicines to your esteem and practise.

For I do not ignore, *Pyrophilus*, that not onely the Generality of the Galenical Physicians, but divers of the more eminent, and judicious of the Chymists themselves, have been pleased to condemne the internal use of Liquors driven through a Retort, by the violence of Fire, upon the scores of their being offensively Empyreumatical, and Stinking: among which sort of Liquors I cannot expect, that our Spirits of Blood, Harts-horn, &c. will escape the being reckoned. But forasmuch as the prosperous Effects I have had opportunity to see, of divers Remedies of that Nature, have given me for them rather an esteem, then either a detestation or contempt; I suppose it may prove no unreasonable piece of Justice to the Spirit of Blood, and the other Noble, though fetid Remedies I have been setting you down; nor no unserviceable piece of Charity to men, if in this place, and once for all, I spend some lines in endeavouring to rescue these crimated Medicines from the great prejudice they suffer under, and from a reputation, which whilst it render them more odious then even their smell can do, is likely to make men deny themselves the benefit of them.

Concerning the
Empyreuma of
Chymical ex-
tracts, and their
offensiveness
compared with
the Galenical
and those which
are commonly
used by the Me-
thodists.

And whether
the offensiveness
of divers Chy-
mical Medi-
cines proceed
from the vio-
lence of the fire,
or the nature of
the matter.

I might *here* on this Occasion call in Question, whether not onely Galenists, but even many Chymists themselves, be not somewhat more afraid than they need be, of what they call *Empyreuma*. But I will suspend a *while* that Question, and at present confesse to You, that I have sometimes doubted whether or no that stink which is generally called by the newly mentioned name, do alwayes and necessarily proceed from the impressions of a violent Fire. For to make a pure Spirit, and Salt of Urine, there needs nothing, but to let it in a well stoppt vessel putrifie for a competent time (as we elsewhere reach) in a Dunghil, or any resembling warmth, (and that it self, perhaps, is not necessary to its Putrefaction;) and then to draw off an eighth or tenth part of the Liquor that first ascends by the gentle heat of a Bath. By which, or by the yet milder warmth of a Lamp-furnace, it may be sufficiently rectified, and brought to yield, besides the Spirit, good store of Salt. And since the Spirit thus made differs so little in Smell or Taste from those of Blood and Harts horn, that most mens Noses are not critical enough to distinguish them, (and We have sometimes taken pleasure to make Chymists themselves to mistake the one of those Liquors for the other.) It seems worth considering, whether or no the fetid and urinous Taste and Smell, which in these Spirits is said to be Empyreumatical, and to proceed from the Adustion of the Fire, be not the Genuine Taste and Odour of the spirituous & saline particles of the mixed Bodies themselves, which they would manifest if they were copiously extricated (to speak in the Kings language) separated from the other *Principles* or *Ingredients*, and associated into one Body, though without the violence of the Fire. For to distill the Spirit of putrified Urine, wherein the like Smell and Taste are eminent, there needs (as we said) no greater heat than that of a Lamp furnace, or of Horse-dung, (since in the latter of these onely, Urine too long kept, and but negligently stoppt, hath been observed to have lost its volatile Salt and

and Spirit, before it was taken out of the Horse-dung. And such a Heat seems not great enough to impress an *Empyreuma* upon such a Liquor. For we see that most things distilled in the greater heat of a Bath, are commended by Physicians and Chymists for their being free from Empyreume. And what Activity may be acquired by the subtle parts of a mixed Body, by the convening (if I may so speak) of such Spirituous Particles, disengaged from those other parts which clog'd or imprison'd them, without any Empyreumatical Impression from any violent or external Heat, may appear by the Chymical Oyles of Spices. For though they be usually drawn by Chymists and Apothecaries, by the help of Water in Limbecks; and though they have by us been drawn after another manner (which we may elsewhere teach You) with a much gentler heat (sometimes not exceeding that of an ordinary *Balneum*) yet these well Dephlegm'd Liquors, retaining so well the genuine Taste and Smell of the Concretes they were drawn from, that they pass unaccus'd of Empyreum, are some of them much stronger and hotter than the Spirit or Salt of Mans Bloud, or Hart's horn. As may appear, especially by the Oyle of Cinnamon, which if pure, is more penetrant and fretting, than any thing but tryal could easily have perswaded me. And lest you should object, that the fire doth considerably contribute to the strength of these Liquors otherwise then by disengaging the Particles they consist of from the unactive parts of the concrete, and assembling them together; I must advertise you, that I have observed little lesse Heat and Penetrancy, than in divers of these, in some Liquors separated without the assistance of Distillation: as for instance, in the purer sort of the true Peruvian Balsam, and in another kind of natural Balsam, almost of an Amber-colour, which belonged to an Eastern Prince (who carried it up and down with him as a Jewel) whose Domesticks at his death sold it, whereby I came to procure some of it, and found cause to

wonder at its strength both upon the tongue, and in its Operation. But granting, *Pyrophilus*, that the volatile Remedies treated of in these Papers, may have their offensive Smell and Taste imputed to the Fire, yet perhaps Physicians would more slowly, and more tenderly censure the Remedies in question for their Empyreumatical stink, if they did but consider, that they themselves scruple not to use (to name those among many others) *Senna* and *Scammony*, though the former be wont to gripe the Guts, and the latter have an Acrimony, Heat, and Mordacity so unkind to the Bowels, that a few grains exceeded in the Dose turns it into poyson; because the ill Qualities of these Medicines, may by proper Correctives be somewhat mitigated, and the Good they do, doth more than countervail the Inconveniences that attend the use of them. For the very same considerations, *Pyrophilus*, will be applicable to the excuse of those fetid Medicines, for which we Apologize. For though the *Empyreuma* or Impression of the fire, for which they are rejected, be the Quality, whose absence from them were very desireable; yet may that *Empyreuma* by dextrous Preparations be in some measure corrected (insomuch that I have known highly-refined spirits of Urine, by being digested for divers months in an exquisitely stoppt Glasse, brought to be of a Sent, which to me seem'd scarce at all stinking, and to others even pleasant) and the prejudice that may be justly feared from what remains, is advantageously recompenc'd by the benefits accruing from the efficacy of their more friendly endowments. And in effect we find, that the Dogmatists themselves are grown not to scruple the administering the spirit of Salt, though extorted (if it be of the best) by a much greater streffe of Fire, than is requisite to the Distillation of any of the Medicines we defend. And not onely the famous *Riverius* (as we have elsewhere noted) extols the Spirit of Tartar, and Soot, which are yet sufficiently fetid and Empyreumatical, but several other (and amongst those

some

some of our eminent English) Physicians frequently use, and commend the oyl of *Gujacum*, forced through a Retort. And no lesse do divers learned Doctors esteem, and employ the Empyreumatical oyl of Amber: Though (to no more so much by the way) That be in divers cases far inferior to the Volatile Salt, which (if the fire be skilfully administred) may at the same time, and by the same Operation be obtained. This Salt besides the Efficacy ascribed to it in the Convulsions of Children, having been lately found by Experience to be an excellent Medicine against the Epilepsies, even of well grown Persons, being administred in the Dose of not above a Scruple or half a Drachm, in a due quantity of Peonie water, or some other proper Vehicle.

And on this occasion You may also be pleased to take notice, that foliated Gold, is ordinarily and without scruple employed by Physicians, not only to cover Pills, but as a main ingredient (though how properly I define not) of several of their richest Cordial Compositions extant in Dispensatories; and yet to how great fire Gold is wont to be exposed before it be melted out of the Ore (wherein tis usually, at least as far as we have observ'd, blended with other Metals, and Minerals) and to purifie it upon the Cupel, either with Lead, or Antimony; he that is unacquainted with the Operations of Mineralists, and the Art of Refiners, will not easily imagine. And, *Pyrophilus*, to satisfie You yet farther, that the strong impression of fire in the Medicines, do not alwaies make them so noxious as they are commonly reputed; let me desire you to take notice, that there is scarce any Medicament more generally given, and applauded, even by Methodical Physicians, than Steel, which is often administred in Substance, made up with other Ingredients, into the form either of Pills, or Electuaries. And yet we have wondred to see what great Fires, and violent Blasts of huge Bellows, moved by Water-Engines, are used to melt Iron first out of the

Stone; and if it be to be farther refined into Steel (much of that used in Physick being factitious) a new violence of the Fire is requisite: and though after all this to make astringent *Crocus per se* (which is accounted one of the best preparations of it) they are wont to keep *Mars* (as the Chymists speak) amidst reverberated flames, or in some Glass-man's Furnace for many hours, yea sometimes for divers dayes; Yet this Medicine is with more successe than scruple daily administred by learn'd Physicians, in Dysenteries, Fluxes, & other distempers where astringtion is required. And tis somewhat strange to me, that the having been exposed to no greater a fire than is requisite to distill Spirit of Bloud, or of Harts horn, should be much urged against those Medicines, by those that scruple not to commend, and do almost dailey and oftentimes successfullly, prescribe the Lixiviat Salts of Plants, and particularly of Wormwood, though these are not rightly made, but by the exposing the Concretes even to the violence of an incinerating fire. And as for the unpleasantness of the smells of our spirits of Bloud, Harts-horn, &c. besides that, to very many persons there is no Odour so loathsome, as that of a Potion. We find that the Galenists themselves scruple not in the fits of the Mother (which yet very rarely prove mortal) to repress (as men are wont to suppose) the unruly Fumes by the smell of *Castoreum*, *Assafetida*, and even the Emphyreumatical Odour of the burnt feathers of Partridges: nor do they decline to use these homely, and ungrateful Remedies to the Patients of tenderest Sex, and highest Quality, and indeed in dangerous cases I have known fair Ladies content to think it fitter to take down an ill sented Medicine, than venture the having their own bodies in few daies reduced to worse perfumes. And certainly we may justly say of Health as no lesse then an Emperour said of the gain brought him by Urine, That it smells well, from what thing soever it comes.

But,

But, *Pyrophilus*, if Your Nostrils were so nice, that they must needs be complied with, though with the hazard of impairing the Virtues of the Salts they are offended with, I could propose an effectual Expedient to gratifie them, and being now invited by so pressing an Occasion, I shall not scruple to annex something of it, and tell You, that if we may judge of the Virtues of the Spirit and Salt of Soot (which I am wont to make without addition) by their sensible Qualities: they must be much of kin to those of the Spirit of Harts-horn, and of Urine; (though these be animal Substances.) And therefore having elsewhere more particularly, and by divers Experiments declared the affinity between these Salts in divers regards; it will not, I presume, be looked upon as an unuseful or unseasonable Hint, if I give You a Summary, though but imperfect Account of what I remember my self to have done, in order to the freeing of the Volatile Salt of Soot, from that very offensive smell, which may possibly make many, even of those that need them; abominate those Medicines, how piercing and noble soever, which it blemisheth. The Process is as followeth.

Take a Quantity of a well dephlegm'd Spirit of Wine proportionate to the quantity of Salt, whose Odour You desire to correct; into this spirit, drop as much Oyl of *Rhodium*, or of any other Odoriferous Chymical Oyl, as will suffice to make the Liquor as strongly sented as You desire it: shake the Oyl and Spirit well together, and if they were both well made, the latter will imbibe the former, and sometimes be thereby turned into a whitish Substance; with which if it smell not strong enough of the Oyl, You may by Agitation incorporate more Oyl, and if you judge the mixture too strong already, You may dilute it at pleasure, by the affusion of more Spirit of Wine. This done, put the Salt of Soot into a Bolt-head, or Glass-Egge (according to the quantity that you intend to sublime,) furnished with somewhat a long Neck or

Wayes of taking
ing off the Fe-
tidnesse from
Spirit of Urine,
Harts-horn, &c.

Stem, and afterwards pouring on leisurely your Odoriferous Liquor, You may with it wash down the Salt that is wont to stick in the Neck of the Glafs. After this, you must very carefully stop the vessel with a Cork, and store of hard wax, if you cannot conveniently make use of an exacter way of closing it. This Glasse you must place in a Lamp-furnace, or some other, wherein You may give a very moderate heat, for that will suffice to elevate to the neck and upper part of the Vessel the pure white salt of Soot, imbued (at the second time, if not at the first) with the Sent of the Odoriferous Oyle, which You imployed about the Preparation.

This Experiment, *Pyrophilus*, may prove of that Use in Physick, that it may deserve as well for its Nobleness, as the watchfulness, which is requisite in him that makes it, to be illustrated by the ensuing

Observations.

Observations
concerning this
method of taking
off the
Empyreuma.

1. Then it is requisite that the Spirit of Wine be very good. For that which is not sufficiently Dephlegm'd, will not readily and perfectly receive into it self the Odoriferous Oyl, wherewith it is to be performed. Nor would every Chymical Oyl, although it were well sented, be fit for this Preparation; for divers of them, as Oyl of Turpentine, and Oyl of Amber, will not sufficiently mingle with spirit of Wine, unless they be previously subtilized after a peculiar manner.

2. The Proportion betwixt the Spirit of Wine, and the Oyl that it is to be dissolved in, tis not easy to determine; for a lesser Quantity will suffice of some Oyles, than of other. And the Proportion of them must be varied, according as You would have the sublim'd Salt to participate more or lesse of their Odour, and other Qualities.

3. Great diligence must be used in closing the top of the Glafs, because of the great fugacity, and subtilty of the Salt, whose Avolation is to be prevented: But then much greater care is to be had, that the Heat be not too strong, but as equal

may be, and much inferiour to the Moderate heat of an ordinary Chymical *Balneum*. For tis scarce credible, how easily this unruly Salt will be excited either to make an escape at the mouth of the Glasse, or to break it in pieces. And I remember, among such other accidents which have befallen us in the preparation of this Odoriferous Salt, that having once set some of it to sublime from a perfumed Chymical oyl, though we administred so gentle a heat, that we thought the Vessel out of all danger of being broken, or found open. Yet in a short time the fugitive Salt did with a great noise blow out the Cork that was waxed to the top of the Vessel, leaving in the bottom not a limpid Oyl, but a Liquor of a red colour, and a Balsamick Consistence. But if the Glasse be wide enough to allow these fumes competent room, and if the heat be warily administred, the Sublimation may be well enough performed.

Of the Medicinal Quality of this Aromatical Salt, *Pyrophilus*, we have not yet had opportunity to make tryal, but some esteem may be made of them by calling to mind the Virtues of the simple Salt of Soot, and considering the Nature of the Liquors, from which in this our preparation it hath been Sublimed. The principal, if not the onely thing, that seems to be feared, is, that the Salt of Soot being it self hot, and Chymical Oyls being for the most part eminently so too, our Salt may prove unfit for men of Hot and Cholerick Complexions, and in such distempers as proceed from Excesse of Heat. But then it may be considered in the first place, that the salt of Soot, being of an extremely aperitive, resolving and volatile nature, and carrying up with it in Sublimation only the more fugitive parts of the liquor from which it is sublim'd; it is very likely that the heat produc'd by a Medicine, which by reason of its fugacity would stay but a very short time in the body, will not be so lasting as that of ordinary Sudorificks, which are neverthelesse often administred with good success, even in hot diseases.

Of the Medicinal quality of these Aromatical Salts,

Second.

Secondly, That there are divers Bodies and Distempers, wherein Remedies may be the more proper, for their being somewhat hot; and Experience shews, that in Dropfies (to mention no other Diseases) these volatile Saline Remedies, that set the Bloud a whirling, and powerfully promote its Circulation, may prove very available.

Thirdly, The Heat that may be fear'd upon the use of our Salt, may be either prevented, or at least moderated by the seasonable use of such cooling Remedies, as may be no Enemies to the Operation of this Salt, and yet no friends to the Distemper, against which it is administred.

And Lastly, supposing that the inconveniences proceeding from this Heat were not to be altogether avoided; yet the advantageous efficacy of so powerful and searching a Remedy, may very much outweigh that inconveniency; And therefore *Riverius*, as we formerly told You, commends the Spirit of Soot (though that seem at least as hot as the Salt) in Pleureties; and in the same hot sicknesse, we have, as we elsewhere relate, succesfully administred the Spirit of Harts-horn, whose Qualities are very near of kin to those of Salt of Soot. Other instances of this Nature You may meet with, dispersed in other passages of my Chymical Papers: to which I must adde, that upon the Consideration above mentioned, the Methodists themselves make no difficulty, in Pills and other Medicines, to use the Chymical Oyl, either of Cloves, or of Nutmegs, or even of Cinnamon. And some of our eminentest English Doctors, as I lately noted, have not scrupled of late Years, to use the strong and fetid Chymical Oyles of Amber and of *Gniacum* (and the latter of these in large Doses) whereas in our Preparation, only the finest and most Aromatick parts of the Oyles, seem to be associated with the fuliginous Salt, since the Oyle remaining after the Sublimation, has been observed to be thick and ropy almost like a Syrrup.

But whether or no this Aromatick Salt be a safe Medicine in all hot Bodies and Diseases, it seems very probable, that it will prove a very powerful Remedy in those Distempers for which it is proper. For first, whereas Spagyriste have, with much study, but without much successe, endeavoured to make Oyles capable of being mixt with other Liquors, by depriving them of their oleaginous forme, in which *Helmont* himself complains that they are offensive, we have, by our Preparation, their finest parts associated with the penetrant and volatile Salt: by whose assistance they are not onely fit to communicate their Virtues to Liquors, but assisted to penetrate exceedingly; and perchance also, thereby to obtain such an access to the innermost parts of the Body, as is seldom allowed to Vegetable Medicines. Secondly, we may have by this Preparation one of the most noble and volatile Salts of the World, not onely freed from its stink, but imbued with the Odour, and perhaps divers of the virtues, of what Chymical Oyles we please. And since these Chymical Oyles are by Chymists and Naturalists thought to contain the most noble and active parts of the Vegetables whence they have been distill'd; and since also the Salt of Soot sublim'd from them, carries up with it the finest parts of these Oyles, Why may it not be hoped, that no small number of distinct Remedies may be afforded us by this single Experiment? These Remedies too may be the more acceptable both to Physicians and Patients, because they have not in them any thing that is Mineral, and notwithstanding their great penetrancy and Efficacy have in them nothing of Corrosive, as many of the Saline Remedies prescribed by Physicians in their Dispensatories. And thirdly, That the salt of Soot thus sublim'd may be also enriched with the *Sulphur* or Balsamick part of the Spirit of Wine, which was employed about its preparation, may appear probable enough to him, that shall examine, by his taste and otherwise, such rectified Spirit of Wine as has

had a sufficient quantity of Volatile Salts sublim'd from it. And how Balsamical a substance is diffused through pure Spirit of Wine, may be guess'd at by the great change which is made in the Caustick Salt of Tartar, when it is so dulcified as to make that excellent Medicine, which *Helmont* extols against inward Ulcers, and calls *Balsamus Samech*; which if one had the abstruse Art of so preparing the Salt and Liquor, as to fit them for Conjunction, might be made onely by distilling very frequently pure Spirit of Wine from very fine Salt of Tartar. For by this means the fixed Salt, retaining the Sulphureous salt or Balsamick parts of the Spirit of Wine, (as may appear by the Aquosity of the Liquor that comes over the Helm in this preparation) is thereby so deprived of its caustick tast, that when it will rob no more Spirit of Wine, but suffer it to be drawn off as strong as it was poured on, it will easily in a moist place run *per deliquium*, into a Liquor not of a Caustick, but Balsamick (and as it seem'd to us a pleasant) Tast.

And whereas, *Pyrophilus*, we have complained of the Difficulty we have met with, to mannage the unruly Salt of Soot, and keep it from breaking prison; we must, to make this Experiment be more practicable and useful, advertise You, that You may, if You please, in stead of Salt of Soot Aromatize that of Harts-horn, or mans Bloud. And I might adde, that a very ingenious friend of ours, Dr. N. N. has lately practised yet a more easie and preferable way of preparing Medicines of this nature: But though I have partly tryed his Method, and found it to succeed well enough; yet since I had it but by communication from him, and that he makes a considerable Advantage of it, I must forbear imparting it to You, till I shall have obtained his Consent to disclose it.

I know not, *Pyrophilus*, whether I shall need to adde, That of these fetid Remedies, which are Volatile, and somewhat Sulphu-

Sulphureotis, as I chose to mention to You but a few, to comply with my present haste, which would not allow me to insist on many: so in what I have delivered concerning these few, I have set down Particulars the more fully and explicitly, because I find the Doctrine of Volatile Salts (though in my poor judgment worthy of a serious Enquiry) perfunctorily, and indistinctly enough, handled by the Chymical Writers I have yet met with, which made me the willingier to contribute the few Observations I could readily find of those I have had opportunity to make about them, towards the Illustration of so important a Subject, of which having elsewhere spoken in relation to Physiology (as these fugitive Bodies belong to the Commonwealth of Salt:) I thought it might not be unacceptable to You, if I also considered them a while in relation to Physick, and presented You with some hints concerning their Medicall Uses.

[To the 156th Page, where the Author promises a declaration, how he would have his Praises of Medicines understood.]

And now, *Pyrophilus*, having finished what I thought fit to adde (at present) in the past APPENDIX, I should likewise put an end to the present Exercise of your Patience, but that this being my first Treatise written to You concerning Medicall Matters, and not being likely to be the last which you will meet with among the Papers design'd You, I think it requisite, and not unseasonable to declare to you here once for all, with what Eyes I desire you should look upon what I have written, and shall write, to you concerning matters of that Nature. And first, I must advertise You that I am not so much a Mountebank as to recommend to you the Remedies I mention as certain Cures in the Cases wherein they are proper. For he must have been extraordinarily happy, or very much unacquainted with the Practice of

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Physick,

Physick, that has not found, that even those Medicines which are most celebrated by the best Authors, both Galenicall and Chymicall, do sometimes prove ineffectuall as well as often prosperous; and the Remedy prescribed by the same Physician to twenty Patients sick of the same Disease, has more than once been observed, though it have succeeded in nineteen, to faile in the twentieth. And indeed the Causes of Diseases, the Constitution of Patients, and the Complications of Distempers are so very various, intricate, and obscure, that it is extreemly difficult even for the most knowing and experienced Physician to make an accurate, and constant Experiment in the Therapeutick part of Physick; and consequently such Experiments are much lesse to be expected from Me, whose condition as well as Disabilities forbid me to make the Practice of Physick my businesse, and allow me only to administer it occasionally, either to my own particular Acquaintance, or to such poor people as are not able to gratifie Physicians, or to such as I meet with where there are not any: And thereby I am reduced to learn the Virtues of divers of the Remedies I have prepared by very few or none of my own immediate Tryals, but the Relation of Physicians, who do me the Favour to administer them for me. And therefore, though I endeavour to put them into the hands of faithful as well as ingenious men; Yet not being allowed to be my self a constant eye-witness of the Effects they produce, I must here for all these reasons solemnly professe to you, that as I do not set down Medicinal Experiments, with the same positivenesse that I do Physiologicall ones, so I do not intend to venture the repute of being a faithful Relator of Experiments, upon the successe of any Medicinal Receipt or Proceffe.

Yet in the next place I must tell You, that You would perhaps do Me but right, to think not only that the Chymicall preparation of Remedies are, if you understand them aright,
c andidly

candidly set down, though the Virtues ascribed to them do not constantly upon all Tryals display themselves; but that I have not rashly and inconsiderately, or upon uncertain Rumors recorded the vertues of particular Remedies, which may be good, though they be not infallible. It being sufficient to make a Medicine deserve the title of Good, that it be often (in some degree at least) successful, though now and then it prove not available; especially if it be otherwayes so safe and innocent, that even when it proves not prosperous, it weakens not nature, nor is otherwise noxious. And we must not, *Pyrophilus*, be so timid as to suffer our selves to be perswaded, that if a Patient miscarry after the use of the Remedies, the fault must necessarily belong to the exhibited Medicine. For oftentimes Nature will in spight of Remedies make a *Metastasis* of the peccant matter, and so empair the Condition of the patient; and much oftner before death, the Conflict of struggling Nature, and the conquering Disease doth manifest it self in horrid and dreadful Symptomes, which some envious or ignorant Doctors (for the more learned are wont to be more equitable, and lesse partiall) injuriously impute to the Chymical Remedy, given before the appearing of those Symptomes; never considering that the like Accidents are wont to attend dangerous Diseases, and dying persons, where Galenical Remedies only, and no Chymical ones at all, have been administred. And that divers of the most eminent, and Methodicall of our Modern Physicians scruple not to use frequently both *Crocus Metallorum*, *Merc. Dulcis*, and some other Chymical Remedies, and to impute the miscarriages of the Patients that use them to their Diseases; though not many years since, all the frightfull Symptomes accompanying the dying persons to whom they had been exhibited, were confidently imputed to those Medicines. To which let me adde, *Pyrophilus*, that oftentimes it may be very just to prize an Empiricall Remedy more then a Galenical, though the

Divers Disadvantages of Chymicall and Empiricall Physick in the way of Ministration.

Methodist and the Emperick have each of them by his respective Remedies, performed Cures of divers Patients in the same Disease; *partly* because Empirical Chymists are seldom resorted to but in desperate cases, or till Nature be almost spent, either by the violence of the Disease, or the unprosperous operation of the Medicines employed to remove it; and *partly*, because the Methodist helps his Remedies by premising the wonted Evacuations (by Vomit, Seige, or by Phlebotomy) by varying them according to Emergent Circumstances, by skillfully and seasonably administering them, and by strict rules of Diet; whereas the Emperick oftentimes useth but a single Remedy, and usually without premising general Evacuations, exhibits it not to the greatest Advantage in relation to him, and other circumstances, and is much more indulgent to his Patient in point of Diet: So that when an Empirik, and a rational Physician do both in severall Patients cure for instance the same Plurisie, the Disease may be very often judged to have been removed into one of the Patients chiefly by the Physician, and in the other by the Remedy.

That Chymical Processes stand more in need of clear Relations, than Galenical.

In the third place, *Pyrophilus*, I must advertise You, that though I mention more Chymical Remedies than Galenical, yet it is not out of any partial fondnesse of the former, and much lesse from any undervaluation of the latter; but *partly*, because Chymical processes being wont to be more unfaithfully, or obscurely, set down by Authors then Galenical Receipts, I thought it might save You some labour to receive from me a frequenter account of those, than these; and *partly*, because in many Chymical preparations, divers considerable Changes being to be wrought upon the Concretes to be prepared by them, there is oftentimes so much of Philosophy to be learned by such Processes, that the success of them may prove instructive to you, though it should acquaint you with their Truth only, as they are Chymical preparations, and not

as they are Medicinal Receipts. But otherwise I love to look upon both Chymical and Galenical Remedies, with an impartial eye, and think that neither the former ought to be despised for the latter, nor the latter for the former, for as Chymical Remedies have commonly the advantages of being more durable, lesse clogging by their quantity, and lesse nauseated by Patients; so Galenical Remedies have, when they are of equal efficacy, the advantages of being more cheap, (at least quantity for quantity) more procurable, and sooner prepared. And such is the variety of cases arising from the variety of Constitutions and Distempers, that in some of them the former sort of Remedies may be more proper, and in others, the latter may seem requisite; and in some also, both sorts may alternately be so useful, that neither of them can well be spared.

In the fourth place, *Pyrophilus*, let me advertise You, that divers Chymical Remedies, and some Specificks also which are not Chymical, have seem'd upon tryal less effectual then indeed they are, because they have been tryed by such Physicians as weaken their Efficacy by not administering them as they should. For some Physicians will never exhibit a Chymical Remedy, till the Patients strength hath been almost tired, if not quite spent with the unprosperous use of divers others clogging and debilitating Medicines. Others are so diffident of Chymical Remedies, that they never dare to exhibit them in a full Dose, nor by themselves, but will blend a small quantity of a Chymical Medicine or a Specifick with other ingredients, which either constitute with it a Medicine of new qualities resulting from that mixture, or at least much clog or enervate the activity and virtue of the Chymical or specificck Ingredients: by which, even in so inconsiderable a Dose, these distrustful Doctors dare yet require that great matters should be performed. Of which injurious way of administering the Remedies I recommend to you

Errors in the
Time and dose
of Chymical
Remedies.

Pyrophilus,

Pyrophilus, I do not causelessly desire you to beware: as I may hereafter have occasion to shew you by particular instances of the Reasonableness as well of this Advertisement as of the others which I either have given you, or shall give you, in this and other Papers. And another sort of Physicians there is, who are of so despondent and rather partial an humour, that if a Chymical Remedy, or a Specifick, do not presently performe the hoped for Cure, though they find, that even upon their disadvantageous manner of administering it, it doth good, yet they will quickly desist from the use of it: And because it doth not do Wonders, they will not scruple to affirm that they have tried it, and found it do nothing: whereas they are wont to continue their own courses of Physick without discouragement, though it be usually some weeks before the Patient find any good by them, and oftentimes (as numbers of the printed Observations of Physicians as well as daily Experience testifie) the Patient is by the tedious Course of Physick he has gone through, very little better'd, if not much impair'd. Which I speak, *Pyrophilus*, not with an intention to disparage Physicians in general, the most learned and ingenious of them being free enough from the partiality I here take notice of; but to keep good Remedies from being disparaged by the envious or unskilful tryals of bad Administers: And though indeed some Chymists are so vain-glorious or unwary, as to promise that the Operation of their Remedies should be as well suddain, as effectual, yet if the Medicines themselves be found availeable, although not swiftly so, that slownesse ought to make us but condemn the Boastings of the man, not reject the use of the Remedies.

*And in the last place, *Pyrophilus*, I must advertise you, not to expect that every one of the Remedies I commend should be Physick and Physician too: I mean, that it should of itself suffice to perform the Cures of those Diseases against which it is commended. For Medicines are but Instruments

in the hand of the Physician, and, though they be never so well edg'd and tempered, require a skilful hand to mannage them: and therefore I cannot but admire and disapprove their boldnesse that venture upon the practise of Physick, wherein it is so dangerous to commit Errors, barely upon the confidence of having good Receipts. For though by Conversation with eminent Physicians, I have found the learnedest of them to disagree so much about the Nature and causes of Diseases, that I dare not deny but that he may prosperously practise Physick, that either ignores or dissents from the received Doctrines of the Schools concerning the causes of Diseases, and some other Pathological particulars, yet I cannot but dislike their boldnesse who venture to give active Physick, either in intricate or acute Diseases, without at least a Mediocriety of knowledge in Anatomy, and so much knowledge of the Historie of Diseases, as may suffice to informe them in a competent measure what are the usual Symptomes of such a Disease; what course Nature is wont to take in dealing with the peccant matter, and what discernable alterations in the Patients Body do commonly forerun, and thereby foretell a *Crisis*, or otherwise the good or bad event of the Disease. To all which is to be added some tolerable measure of Knowledge, not onely of the *Materia Medica*, and the chief wayes of compounding several Ingredients into Medicines of several Forms and Consistencies, as circumstances may require; but also of the orderly and seasonable administration of the helps affordable by them. These particulars, *Pyrophilus*, might easily be enlarged on; but having neither the leisure nor design to handle them common-place like, I shall onely give you this account of my requiring in the profess'd Practiser of Physick some knowledge both of the *Materia Medica*, and the Method of compounding and administering Remedies, that (excepting perhaps the *Arcana majora*, as Chymists call them) even the best Medicines by being unseasonably

That a competent measure of knowledge is absolutely necessary to a Practiser of Physick.

or prosperously administred, especially in acute Disease where Natures motions are to be diligently watcht, and seconded, may do a Patient as much harm as the orderly and skilful administration of them can do him good. And that be that has nothing but one good Receipt for a Distemper, and knows not how to vary it by adding, omitting, or substituting other parts of the *Materia Medica*, as urgent occasion shall require, may oftentimes find himself reduced either to suffer his Patient to languish helpless, or to venture by curing him of one Disease to cast him into another. For sometimes the Patients constitution makes the Medicine prescribed by the Receipt unfit to be administred; and sometimes too, the Disease, for which the Receipt is proper, is in the Patient complicated with some other Distemper which may be as much increased by the Specifick, as the other Disease may be lessened. I know for instance some eminent men that are wont to cure very stubborn Venereal distempers, by a Chymical preparation (which some of themselves have been pleased to disclose to me) of the *Indian* plants, *Sarsaparilla*, *Guaiacum*, &c. But if these men met with patients, such as those which *Eustachius Rudius* mentions himself to have often met with, who upon the use of the least quantity of *Guaiacum*, though corrected with cold Ingredients, were wont to be presently affected with such sharpnesse of Urine, and inflammation of the parts, to which Urine relates, as hazarded their lives; they would be reduced, as well as our Author confesseth himself to have been, to have recourse to *Mercurial* or other Remedies. To which we may adde, that the use of *Sarsaparilla*, and *Guaiacum* is generally forbidden by the warier sort of Physicians, in those Patients, whose Venereal Distempers are complicated with heat or Inflammation of the Kidneys or Livers. And sometimes also it happens, that the very outward form of the Medicine prescribed by the Receipt is not fit, or perhaps possible to be administred: For, not to mention that

divers

divers Patients can retain no purgative Physick exhibited in the form of a Potion: and some others as are apt to Vomit up whatever is given them in the form of Pils; not to insist on this I say, I shall content my self to relate to you a memorable Case that hapned a while since to a Physician of my acquaintance. He was called to a lusty young woman, who upon an accidental but violent Cold was suddenly taken with such a Constriction of the parts inservient to Speech and Deglutition, as made her altogether unable either to speak or swallow any thing at all: and having thus continued some dayes in spight of Glisters or other Remedies prescribed by a very Learned Physician, and in spight of Endeavours to excite Vomiting, by making her hold Emetick things in her Mouth; the poor Woman was in great danger (when my acquaintance came to her) of perishing for hunger. What in this case could be expected from the best Remedies, that must necessarily be taken in at the Mouth? Wherefore the Physician finding her yet strong enough, and without Feaver, and yet her case almost desperate, did as judiciously as luckily prescribe a Glyster, wherein to ordinary ingredients were added (as himself a very few dayes after told me) about four ounces of the Infusion of *Crocus Metallorum*, with an advice that it should be kept in as long as possibly she could, and by this Medicine, Nature being sufficiently irritated, there quickly followed upon it some violent Vomiting, and upon them a liberty both of Swallowing and Speaking. [And since this, a young Gentleman and Fellow-traveller of mine, had the Organs of deglutition so strangely weakned without any manifest cause, that though he were able to make me a Visit, and acquaint me with his Case, yet he was very apprehensive, he should in a very dayes be starved, and being unable to swallow Remedies, had quickly perished in despight of the *Arcana Majora* themselves, had he been master but of such of them as (like those wont to be magnified by Chymists) must be

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taken into the body; if a very happy Physician to whom I directed him, had not by a very Efficacious and Specifick Medicine externally to be applied, seasonably rescued him from so unusual and desperate a Case.] But, *Pyrophilus*, as I would not upon the score of good Receipts have the Physicians skill despised, or thought useless; so I wish that the Physicians skill may not make him despise good Receipts. For we have often seen (especially in outward affections) not onely Empericks and Chirurgeons, but even Ladies and old Wives, with a lucky composition prescribed by a Receipt, perform more constant and easie Cures of the particular Distemper, for which that Receipt is proper, than even Learned Physicians by their extraordinary, though pompous and artificial Prescriptions. And the illustrious Lord *Verulam* (one of the most judicious Naturalists that our Age can boast, (think fit to take notice of it as a Deficiency, that Receipts by long Experience approved, are not more closely, and as he speaks *religiously adher'd* to, but altered upon every light occasion. And in the same Chapter to answer the principal, as well as the most obvious Objection in this matter, "That, says he, any man induced by some specious Reason should be of opinion, that it is the part of a Learned Physician (respecting the Complexions of Patients, their Age, the Season of the year, Costume, and the like) rather to accommodate his Medicines as occasions suggest, then to insist upon some certain Prescripts, is a deceivable Assertion, & which attributes too little to Experience, too much to Judgment. And a little above He goes much farther than we pretend to do, for speaking of the Neglect of the use of particular Receipts, which, as He speaks, by a kind of propriety, respect the Cure of particular Diseases, He addes, severely enough, ("That the Physicians have frustrated and taken away the fruit of Traditions, and approved Experience by their *Magistralities*, in adding and taking out, and changing ingredients of Receipts at their pleasure

*De Augment.
Scient. lib. 4.
cap. 2.*

The Lord *Verulam's* judgment, That approved Receipts ought not to be altered, but religiously adher'd to.

Crao's judgment had herein, and the Author concurs with that Eminent Physician.

pleasure, and almost after the manner of Apothecaries, putting in *Quid pro quo*, commanding so presumptuously over the Medicine, as the Medicine can no longer command the Disease. Thus far our Judicious Author: But I will rather choose to expresse to You my sense on this whole Subject of Receipts, in the words of that Experienc'd Physician to three Emperours, *Johannes Crato: De morbi natura* (sayes He) *causa, locorū, affecto, Medicus diligenter cogitet, atque in eplus quam in certis medicamentorum mirificis formis situm paret. Medicinam tamen expertam cum ratione adhibitam plus valere quam ea qua interdum subito à Doctissimo etiam Medico magna ratione exhibita excogitatur, non dubito: Atque hac in parte Rationales etiam Medicos Empiricis cedere debere de sententia Hippocratis statuo.* Only I must adde by way of Explanation, That this sentence is to be understood to expresse my sense, when the Medicines used are not very extraordinary, but such as *Crato* employed, and hath left us in his Writings: for there may possibly be such effectual Specificks, and such powerful and commanding Remedies, that the efficacy of the Medicine may (at least in some particular Diseases excuse and repaire much want of skill in the Prescriber.

Consil. 322.

If the Testimony of *Helmont* concerning the *Arcana* of *Paracelsus* be considerable, even in a Tract (where either out of Emulation or Judgment, he endeavours somewhat to depreciate both them and their Author) much greater things might be boldly affirmed of some *Arcana*; for *Fatcor Lubens* (sayes he, speaking of *Paracelsus*) *Me ex ejus scriptis profecisse multum, illumq; potuisse, per Remedia ad unitatis Symbolum ascendentia, sanare Leporam, Asthma, Tabem, Paralyfin, Epilepsiam, Calculum, Hydropem, Podagram, Cancrum, atque ejusmodi vulgo incurabiles morbos: attamen Paracelsū fuisse ignarū radicis vitæ longæ, tam ex ejus scriptis & medicaminibus quam ex Obitu collegi, &c.* And in the same Tract, just before He comes to enumerate *Paracelsus's Arcana*; *Concedo*, saith he,

Helmont, in Arcan. Paracels. pag. 787.

Of the greater *Arcana*, and more Universal Medicines, the Efficacy of which may compensate for want of skill in the Prescriber. *Helmont, in Arcan. Paracels. pag. in 790.*

Universales aliquot Medicinas, quæ sub unisono Natura lætissimò, insensibiliter post se vinetum educunt hostem, cum egregia Organorum depuratione; Concedo pariter appropriata aliquot quo Universalis amplitudinem in specificis morborum directionibus emulantur. And among those Arcana themselves that is rankt but in the second place, of which he gives this Character: *Sequitur dein Mercurius Vita, Stibii proles integri, quæ omnem morbi nervum penitus absorbet.*

And because another Arcanum doth not so powerfully renovate, as that last mentioned, and two more; he allows to those three others the precedencies of that whereof he yet saith: *Quarto loco est Mercurius Diaphoreticus, melle dulci & ad ignem fixus, solis Horizontes omnes proprietates habet, perficit enim quicquid Medicus & Chirurgus possint optare sanando.* But because, that any Medicines should be qualified to deserve such superlative Encomiums, may seem a thing fitter to be wished than credited, I would not dissuade You till the Chymists Cures have made good their Masters brags, to be altogether of our Authors mind, who somewhere professes, *Se morbum non distinguere, si Remediis* (sure he speaks of such Remedies as he thought he had) *fit summa bonitas.* But yet you may perchance ascribe much more even to Remedies far inferior to the Arcana Majora, in the cases wherein they are most proper, than many are willing to believe. Inasmuch that I have sometimes observed with wonder, that an Excellent Person (whom I need not name to You) Cures the Rickers generally in Children of several Ages and Complexions without having hitherto failed (as she professes) in any one, by prescribing no other Remedy than the single use of the above described Colcotharine Flowers, which I presented Her with. And a couple of Physicians also, to whom I recommended them, tell me, They have tryed in the same Disease with the like success, as this Lady hath hitherto met with. And I remember, that eminently learned & experienc'd Physician

The Sum and Conclusion of the point in controversy.

Dr. G. Boer, (of whose skill both your excellent Mother and you have had good proof) solemnly assured me, as I elsewhere also note, That he knew a Physician who constantly cured within two or three fits all Agues, whether recent or radical, in persons of all Ages, Sexes, and Complexions, indiscriminately with one single outward Application to the Patients Wrists; but that this envious Doctor would never part with it to our Friend, or any else, no not upon his Death-bed: only *Dr. Boer* discovered, That Spiders, or something coming from them were main Ingredients of his *Pericarpia*.

And indeed there are certain Preparations and Compositions of Remedies so lucky, and whose Successes doth so much exceed Expectation, and the Efficacy of common Compositions; that the same Physician, whose they are, may upon several Occasions prescribe an Hundred others, each of which he may think as rational as any of those, which nevertheless shall be all of them much inferior thereunto. And therefore I wonder not, that the most learned of the Methodists themselves have much valued and celebrated some peculiar Processes and Receipts, as here amongst us (to mention no others) the famous *Sr Theodore Mayerne*, was wont almost in all Obstructions, Cachexies, and Hydropical Distempers to magnifie and use that peculiar Salt of Steel of his, which he was pleased to call *Anima hepatis*.

And to these Domestick Instances (which I might easily accumulate) of the esteem eminent Physicians have made of Receipts, I might adde very many forreign ones. Nay *Galen* himself, who has so copiously treated of the *Materia Medica*, and the *Composition of Medicaments*, though he were sufficiently expert at drawing up Receipts, doth yet in his Book *De Compositione Medicamentorum*, and elsewhere transcribe, and sometimes commend (and mention his having used) divers of the Compositions of Ancienter Physicians, and especially magnifies *Andromachus* his Treacle.

I might, *Pyrophilus*, here mind you, That we see that Chymistry, as incomplete as yet it is, has been able so much to improve the preparation of remedies, as to afford us some, which are so innocent as well as Efficacious, that in the Diseases they principally respect, they require not, as of Necessity, near so much of Theoretical skill, as others do in the Administering. I might likewise take notice, That Experience also teacheth, especially by what we see performed by the *spas*, and some other Mineral Waters, that one Medicine may be so richly endowed, as to be more effectual against several differing Diseases, than even the better sort of other Remedies against any one particular Disease.

I might further represent as something that makes yet more to my present purpose, that though every Body can advise his sick Friends to an Air that is famously healthful, if there be any within a convenient Distance from them; Yet there are some Aires so eminently good, and that not upon the Account of any one predominant Quality that makes them opposite to a disease springing from its contrary, but from a hidden Temperature, or certain friendly *Effluvia*, that they alone often cure Variety of Diseases in persons of differing Ages and Complexions: as Navigators observe in the Isle of *St. Helen*, where the *Spaniards*, and some other *Europeans* in their passage to the *Indies*, often leave without Physicians great numbers of Sick, whom they find for the most part recovered at their return. And that sometimes even the acutest Diseases may by the Sanative Steams that enrich the Air, be cured almost in a trice, is assured by those that have lived in grand *Cairo*, who have affirm'd to me, what the learned *Prosper Alpinus*, who so long practis'd Physick there, assures Us, That upon *Nilus's* beginning to overflow, though in the Heat of Summer, there ensueth a suddain Recovery of those multitudes of persons of differing Ages, Temperatures, Sexes, &c. which there happen at that time to lye Sick of the

the Plague. These things I say, *Pyrophilus*, and more I might add, to what you may find dispersed here and there in the ESSAYS which this Paper accompanies towards the inferring that we should not hastily conclude it *impossible* that there may be found such Medicines as may be more than particular and Specifick Remedies without requiring the Giver to be a great Physician. But to draw at length to a Conclusion, I shall rather Summe up my present thoughts of this Matter, thus.

Ordinary Receipts without an Ordinary measure of skill in Physick are not rashly to be relyed on, especially in Acute Diseases; where, by giving Medicines, otherwise innocent enough, to lose the opportunities of administering proper ones, may be very prejudicial: and where sometimes the severall seasons of the diseases do require such differing Remedies if they be but Ordinary ones, that a Medicine proper enough for the disease at one season of it, may do mischief at another: But if indeed there be Noble and Extraordinary *Arcana*, that work rather by strengthening and restoring Nature, and Resolving, or otherwise destroying the peccant matter they find any where in the body, than by irritating and weakning Nature, or putting her as it were to a troublesome plunge: the use of such Remedies may deserve to be a litle otherwise considered, as that which may not ordinarily (for I say not Ever) require more Instruction then may be afforded to persons not Indiscreet by such Directions and Cautions as maybe Divulged, or otherwise Communicated, together with the Remedies themselves: As we sometimes see that by the help of such Instructions unlearned persons, and even old Wives do with some one Sovereign Plaister, Balsam, or other outward Remedy, cure many and various Tumors, Ulcers, and other Sores in Persons of differing Sexes, Ages, and Complexions. And because you will easily grant that this Example does far lesse accommodate our present purpose than

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does the Case it self, as I just now put it, I hope you will allow me to represent further, That at least it seems not so Rational to judg of all the Remedies that Art improving Nature can afford us by those that are hitherto in use, either among Methodists or Vulgar Chymists, but rather to think that the Noblenesse of Remedies will be advanced according as the Art of preparing them shall be promoted, and that it is not so safe and easie, positively to determine the Efficacy of the former, otherwise than in proportion to the Discoveries we have attained to in the latter.

The End of the APPENDIX.



The CITATIONS *Englisht.*

AD Pag 6. *In Corpore, &c.* But I dare not try those things upon Humane Body, which have not been before tryed upon former Experiences; For the End of such rash Experiments may be the ruine of all Lives.

Ad pag. 9. Naturalium, &c. This is the Course of Naturalists and Physicians, who prosecute their Art Philosophically; The Naturalist ends where Medicine begins, and Medicine begins where the Naturalist endeth.

Ad pag. 11. Sunt enim, &c. The parts of Humane Body are unknown, and therefore we ought to consider them by the parts of other Animals, to which they are like.

Ad pag. 19. Hoc in, &c. This I have more than once Observed in *Lizards*, which I kept in my own House. For my Children being at play, when with a Rod they had struck off the *Lizards* Tails, I saw them within a day or two come out to feed, and their Tails then by little and little still increasing and growing bigger.

Ad pag. 73. Neque, &c. Nor may we be ignorant that in acute Diseases, the Notes of Life or Death are more fallacious.

Ad pag. 75. Quidam, &c. One who before he fell into the French Pox was blind of a Cataract in one of his Eyes, by being anointed with Quick-silver, was recovered; not onely from the chief Disease, but (which was most strange) from his Cataract. Nor is it irrational, that Cataracts should be dissolved by such anointing: when Experience teacheth, That hard Tumors clogg'd together of pituitous Matter are powerfully dissolved by Mercurial Inunctions.

Ad pag. 78. Ejusq., &c. And they urge many Instances of it even to my admiration.

Ib. Aiumt, &c. Yet they say that the seed of the *Calchou*, grown'd, and taken in any proper Water doth dissolve the Stone into a very Dirt, which being voided doth harden again into a stony substance. I saw a young man, to whom (upon my knowledg) this accident befell. When he was tormented with the Stone in the Bladder, which I understood both by the Lithotomist who felt it, and by the Symptomes which he suffered: I sent him to a Fountain, which takes its name from *St. Peter*: when he had staid there two Moneths, he returned free from the Stone, and brought home with him all the Dirt which he had voided by degrees, in a paper, coagulated as it were into fragments of Stone.

Ad pag. 85. Hic, &c. He loaths nothing that stinks, or is otherwife unpleasant. He hath been often seen to chew and swallow Glasse, Stones, Wood, Bones, the feet of Hares, and other Animals, together with the Hair; Linnen, and Woollen cloath, Fishes, and other Animals alive: Nay, even Metals, and Dishes, and globes of Tin. Besides which, he devours Sewer, and Tallow-Candles, the shels of Cockles, and the Dungs of Animals, especially of Oxen, even hot, as soon as it is voided. He drinks the Urine of others mixt with Wine or Beer; He eats Hay, Straw, Stubble, and lately he swallowed down two living Mice, which for half an Hour continued biting at the bottom of his Stomach; and to be short, Whatsoever is offered him by any Noble Persons, it goes down with him without more adoe upon the smallest reward, insomuch that within a few Dayes he hath promised to eat a whole Calfe raw, together with the Skin and Hair: Among divers others I my self am a Witnesse of the Truth of these, &c.

Ad pag. 86. Causam, &c. To find in the Carcasse, the cause of this Voracity, will be questionlesse very difficult. Some one perchance would refer it to that which *Columbus* observed in the

the Carcasse of *Lazarus* the Glasſe-eater, and reſolve that the fourth conjugation of Nerves which Nature ordain'd for taſting, come neither to the Palate, nor the Tongue: But ſo there would only be rendred the cauſe of this want of Taſte, and not why he ſhould be able to take ſuch uncouth things without offence to his Stomach and digeſt them, which without doubt ought to be the particular and ſingular conſtitution of his Stomach and Guts, which yet may not appear to the Eye by the Effects.

Ad pag. 91. De Laudano, &c. Of his *Laudanum* (that Name he gave to little Pills, which in the extremity of Diſeaſes he adminiſtred as a moſt divine Medicine, always giving them in an odde number) he ſcrupled not to affirm that by that Medicine he could put life into thoſe who were as good as dead; and that while I was with him, he made good in ſome Experiments.

Ad pag. 94. Oportet ubi, &c. Where a Medicine answers not, we ought not ſo much to eſteem the Author as the Patient, and to try ſomewhat farther and farther.

Ad pag. 97. Idem fit, &c. The ſame is made of *Mandioca*, Potatoes, Turkiſh Muller, Rice, and other things which being chewed by old Women, and ſpit together with much Spittle, this Liquor is ſtrait put up into Veſſels, and there kept untill it ferments and caſts down a Sediment.

Ad pag. 103. Hoc eſt, &c. This *Birchwater* hath a ſweet Sharpneſſe, and very pleaſant Taſte; it allayes Thirſt, and the dryneſſe of the Entrails; it tempers the heat of the blood; it opens Obſtructions, and drives out the Stone.

Ad p. 111. Conſciunt, &c. They make Drink of that *Mulli*, rubbing it gently in their hands in Hot-water, untill they have rubb'd out all the Sweetneſſe; they ſtraine that Water, and keep it three or four Dayes, untill it ſettle, and then it becomes a very clear Drink: The ſame Water boil'd turns into good Hony—Of this fruit boil'd with Water according

to different manners is made Wine, or good Drink, or Vinegar, or Hony.

Ad p. 112. Porro, &c. Then by cutting the Shoot with a Razor-blade made of a Flint, there runs out of the Cut a certain Liquor in such a quantity, that (which is wonderful) out of one single Plant, sometimes Fifty or more *Aroba* run out: From which Liquor there is made Wine, Vinegar, Hony, and Sugar. For the Liquor sweet of it self, is by being boyl'd made much sweeter and thicker, so that it at length kerns into Hony.

Ad p. 113. Semel, &c. If once in a Moneth one eat or drink to excess, the Day following, if he be weighed (though he hath suffered no sensible Evacuation,) yet then he will weigh lighter then is usual. A constant Diet wants the help of those that once or twice in a Moneth do exceed: For the Expulsive faculty being oppressed by too great Repletion stirs up so much of perspiration, as without the Staricks no one would be believe.

Ad p. 123. In urbe, &c. In the City *S. James's* that is in the Province of *Chyle*, certain Captive *Indians* cut off the Calves of their Legs; and for hunger eat them, and (which is strange) applying the leaves of a certain Plant to their Wounds, immediately they stanch the Blood.

Ad pag. 124. Memini, &c. I remember that the Limbs of Souldiers wounded with Gunshot, to have been cut off by the advice of our *European* Surgeons, both *Dutch* and *Portugal*, those Barbarous people by recent juices, Gums, and Balsams to have freed them from Knife and Cauterries, and happily cured them. I also am an Eye-witnesse, that with the juice of Tobacco alone, they have cured Wounds given over by our Surgeons.

Ad pag. 131. Experimentis, &c. It is approved by many Experiments, that its Virtues are excellent against the Plague, Malignant Feavers, the bitings of Venemous Creatures, the *Diarrhoea*, and other fluxes.

Ad pag. 135. Nam venena noluit, &c. He made not *Venome* to be our Poison, for neither made he Death nor any Detestable Medicament upon the Earth; but so, that by a slight Industry and endeavour of our own they might be turned into great pledges of his love, for the use of men against the cruelty of Diseases, which were in proceſſe of time to arise. For in those Venomes is the help that more benigne and familiar simples cannot yield; and those more frightful Poisons are yet preserved in Nature for the more great and Heroick uses of Physicians.

Ad pag. 136. That the *Lapis Cancrorum* resolved into the form of its first Milk, affords an Antidote against the violence of many Vegetables, that are infamous for their being over laxative.

Ad pag. 150. Mille, &c. Our Court bath tried the efficacy of this Salt in a thousand Experiments in the Diseases of Melancholly, in all Feavers, continuous & intermitent, in the Stone, Scurvy, &c. Nay more we have observed more than once that it hath procured sleep, especially in persons Melancholly. The Dose is from one, to two Scruples; we use divers pounds of it in a Year.

Ad pag. 150, 151. Caterum quantum, &c. But for the exceeding and portentous Virtues of the Bezar-stone, I have found by a thousand tryals, that they are not so very great.

ib. Nil porro, &c. I speak no more of these Stones, lest I should seem by my Commendation of their Virtues to provoke Lithotomists to make dissections at any rate. This I have most certainly Experienc'd, That the Stone found in Mans bladder, doth well provoke Urine and Sweat. And particularly in the time of that Plague, which in the years 1624. and 1625 miserably vexed Ours, and all other the Cities of *Holland*, for want of the Bezar-stone, I remember, I prescribed this and found it (let me tell you) a more great and excellent Sudorifick.

Ad

Ad pag. 159. Credo, &c. I believe Simples in their own simplicity are sufficient for the curing of all Diseases.

Ad pag. 190. Quod, &c. But if you come not to that *Artium* of *Pyrotechny*, learn at least to make the Salt of Tartar Volatile, that by means of it you may perfect your Solutions. Which though it leave those things which it dissolveth equally Homogeneous, being digested in us; Yet it borroweth some of their Virtues which it carrieth along with it self to overcome Diseases.

Ad pag. 199. Dicam, &c. I will speak it for their sakes, who are ingenious, that the Spirit of Salt of Tartar, if it dissolveth Unicorns horn, Silver, Quick-silver, Crabs Eyes, or other like Simples, it will cure not onely Feavers, but other Diseases in great abundance.

Ib. Mirum, &c. It is a wonder what the very Salt of Tartar alone being made volatile will perform; for it cleanses the Veins of all the feculencies and the causes of Concrumacious Obstructions, and doth disperse the congregated Matter of Apostems. Of this Spirit of the Salt (and not of the Oyl) is that saying of *Paracelsus* true, That whither this Medicine cannot reach, there is scarce any other more powerful that shall reach it.

Ad pag. 201. Ars, &c. Art is long, Life is short. But where the End is by gift, there Art is short, and Mans Life long if it be compared to Art. Therefore *Hippocrates* had reason to make the complaint, for it even happened to his followers according to his words. The Art of Medicine consists in Philosophy, Astronomy, Chymistry, and Physicks, and therefore it may truly be said that the Art is long. For there is much time required, throughly to learn and search these four Pillars of Medicine.

Ad pag. 202. Est enim, &c. For this Art is conjectural, and not onely Conjecture, but Experience it self doth not alwayes answer.

ib. Hæres, &c. Experience is uncertain and fallacious; Judgment is difficult to be made.

ib. Hoc modo, &c. And this was the fashion of Medicine in the beginning, that it had no Theory, onely Experience, that such a thing was Laxative, such a thing Astringent: But how, or why they were so, that was not found out; and therefore one was healed, another perisht: but now, &c.

ib. Per rationem, &c. By reason it is not easie in a Disease to give Judgment, but is as difficult as any thing imaginable.

ib. Neg, &c. For if the truth were easie to be found, so many and so excellent men as have made it their businesse to find it, had never been divided into so many Sects and Opinions.

Ad pag. 203. Non titulus, &c. It is not a Title, nor Eloquence, nor skill in the Tongues, nor the Reading of many books (though these are Ornaments) which are to be considered in a Physician; but a prime knowledge of Matters and Mysteries which alone may stand in the steed of all the rest. It is the part of a Rhetorician to speak eloquently, to be able to perswade and to draw the Judge to his own party. It is the part of a Physician to know the severall sorts of diseases, their Causes and Symptomes, and then with skill and industry to apply Medicines and to make Cures of them all, according to their severall Natures and Fashions.

Ad pag. 207. Imo, &c. Nay, I saw divers, as it were in an instant, redeem'd from death who had been poisoned by the eating of venomous Mushrooms and other unwholsome things, only by drinking a recent infusion of the Root *Faborand*, whilst my self and other of *Galen's* Disciples blusht to see the ineffectual endeavours of all our *Alexipharmaca*, Treacles, and other Antidotes: so that afterwards I suffered my self to be joyn'd in consultation with those barbarous Collegues, not so much to be arbiters of the condition of our men by their Pulse, as to give their assistance and counsell in the fore-mentioned way (*viz.*) the prescribing of proper Medicines.

Ad pag. 208. Huius, &c. The virtue of this Stone is much above that of any other gems, for it stops the flux of the blood in any part.—When the women perceive a fit of the Mother coming upon them, by applying this Stone they are immediately eased, and if they alwaies weare it, they are never troubled with those fits more. Of this they make faith, by many Instances.

Ib. Vidimus, &c. We have seen some that were troubled with the flux of the *Hamorrhoides*, who found Remedy by wearing Rings made of that Stone continually on their Fingers, and the Monethly flux is staid by the same way.

Ad pag. 209. Pregnantibus, &c. This Stone is not proper for those who are with Child, for it is so sure to cause Abortion, that the women of *Malaica* told me, that if at any time their Monthly Evacuations were obstructed, that if they onely carried this Stone in their hands, they found Remedy thereby.

Ad pag. 210. Hoc loco, &c. In this place I cannot but relate the admirable Virtues of our *Electrum*, which I have observed with my own Eyes, and therefore can attest with a good conscience. For we saw Rings of it, which he that wore neither felt Cramp, nor Palsie, nor other pain. He was subject to no fits of Apoplexy, nor Epilepsy, insomuch that if one of these Rings were put upon the Ring-finger of a person actually in any vehement fit of the Falling sicknesse, that fit would immediately assuage, and the person as soon come to himself.

Ad p. 225. In the City *Pasto*, where I lived certain years, a certain *Indian* cured all sorts of Diseases by the juice of one Plant alone, wherewith he anointed the limbs and any other part particularly affected, and then covering them warme with Blankets provoked Sweat. The Sweat that came from the parts so dawbed were meer Blood, which he wiped off with Linnen Clothes, and so he proceeded untill he thought they

had

had Sweat enough. In the mean time he gave them Diet that was most Nourishing. With this Remedy many desperate Diseases were cured, and the sick person upon the Use of this Physick improved, so as to appear younger and lustier after it. But we could never prevaile, neither by Money, nor intreaty, nor foul means upon him to shew us the Plant.

Ad pag. 227. Mira, &c. Wonderful things are daily found out in Physick to the Confirmation of the Operation of the Learned Naturalist *Petrus Servius's* Weapon Salve. For he assured us that a piece of Cloth dipt in the Blood, and put under hot Ashes stops the Monthly Flux; the Experiment having been often proved. And my Master *Petrus Castellus* affirms, as he found by Experience, that the *Hemorrhoides* if they were touched with the tuberous Root *Chondrilla*, did dry away if the *Chondrilla* dried, and did Run to Corruption if the *Chondrilla* was corrupted. And therefore after such touching of the Hemorrhoids, the *Chondrilla* was usually put to dry in the Chimny.

Ad pag. 229. Podagra. &c. The Gout it strangely eased, if Puppies lie with the person that hath the Gout, for they contract the Disease so as not to be able to go, but the Patient thereby findes Ease.

Ad pag. 336. Primo, &c. At the first, Physick was accounted part of Philosophy, so that the Cure of Diseases, and the Contemplation of Nature, did both arise under the same Authors. Those being most set upon Medicall Enquiries, which had made their Bodies infirme by disquieting thoughtfulness and nocturnall Watchings.

Ad pag. 204. Est, &c. Besides, it is altogether drying, and therefore I should not despair that it, being hung about Childrens Necks, might cure the Falling-sickness in them. I truly saw a Lad, that sometimes would be eight whole Months free from the Falling-sickness, and then, when by chance this fell from off his Neck, he became immediately

surprized with a Fit : and again, hanging another Root in its place, he would continue well ; Therefore, for Experiment sake, I thought good to take it again from his Neck, which when I had done, and found that the Lad fell into his former Convulsions, we took a great piece of a green Root, and hung it about his Neck, and from that time He continued well and felt no more Convulsions. It was therefore most probable, that either certain parts did exhale from the Root, and were drawn into the Body by Inspiration, which did so work upon the affected parts ; or that the Ambient Air was continually changed and altered by the Root: For after this manner the *Succus Cyrenaicus* cures the *Phlegmone* upon the *Uvula* ; so Catarrhs and other Rheums are dried up by *Melanthisum*, if it be tyed up warm in fine Linnen, and the hot fume of it be drawn up into the Nostrills by Inspiration. Nay, if you strangle a Viper with divers sorts of Threeds, and especially with the Sea Purple, and then you tye those Threeds about the neck of your Patient, you shall cure the swelling of the Almonds of the Ears, and all other swellings in the Neck.

Ad pag. 257. Pestis Cayri, &c. The Plague at *Grand Cair*, and in all parts of *Egypt*, is wont to invade the Inhabitants from the beginning of the Month *September* untill *June*: For in all these Months, from *September* unto *June*, the Plague from other Nations is brought thither, and is wont to infect that Nation: But in the Month of *June*, of what nature and how great soever the Pestilence be, when the Sun first enters *Cancer*, it is immediately removed ; which thing many (and that not without reason) take to be a particular Mercy of God. But (what is more admirable) all Household-stuffe, how ever infected with the Contagion of the Disease, at that time shews no effect of any Contagion, so that then the whole Nation passes into a most secure & healthy condition, from a morbid and dangerous : and then those Diseases, which are called
by

by the Greeks *Sporadici*, begin to appear, which in no part of the World are seen to be rife together with the Plague.

Ibid. Hac, &c. These things are first observed about that time. From which, I think, and perchance not without reason, the cause of the extinction of the Plague, and the change of the state from Morbid to wholesome doth depend; For no other of the conservative Causes, which are wont to be called by Physicians, *Res non-Naturales*, appeareth then, besides the Air: to which we may referre this change from Disease to Healthinesse, and therefore we must referre this change to the change of the Aire.

Ad pag. 259. The Inhabitants do strange things, both in preserving Health and curing Diseases, by Friction and Unction, using the first in cold and Chronicall, the latter in acute Diseases. And Strangers who arrive there, are, as they ought, willing to imitate their waies of Physick, & by rules of Art to preside and moderate these waies of Emperical healing.

Ib. Cholera Sicca is cured by the same Remedies, especially if their Horny Cupping-glasse be applied to the Region of the Liver, of which I must attest the same thing that *Galen* doth of Cupping-glasses; which he affirmed to work as Miraculously as if their Operation had depended on Enchantment.

Ad pag. 271. Neque, &c. Nor doth he say, that a Physician needs nothing of Councell or Deliberation, or that an irrational Man may professe this Art. But that those Conjectures of hidden things are nothing to the purpose. Because it matters not what causeth the Disease, but what removes it.

Ib. interim, &c. In the mean time the *Brasilian* Brotanists make all sorts of Medicines of Simples they find every where in the Woods: which they make with so great Sagacity, and apply them both internally, and externally, especially to Diseases that Spring from Venom, that a man may more securely give himselfe over to their hands, than to our unskilfull Physicians, who brag much of Secrets they have learnt in pri-

vate, and for the knowledge of these will be called *Rationals* in Physick.

Ad pag. 272. Fartassus, &c. Perchance some Sciollist in Physick may affirm that these things may not be used, by reason of the Narcotick and Stupefactive property. But these pretences are as vain in effect as specious at first sight: for besides that the hot temper of this Countrey requires it: It is sure, that without these Remedies there can be no Cure. Adde that here we prepare *Opium* so well that you may give it to an Infant. And truly, if in Hot Diseases we had no Opiats we should in effect find that the use of all other Medicaments would prove altogether her vain and fruitlesse.

Ad pag. 287. Si Medicinam, &c. Such was the Origine of Physick: by the Recovery of some, and the Death of others it first made distinction between things Sovereign to heale, and things which are improper and Deadly. And thus the Remedies being found out, Men began to dispute of the Reasons of them. Nor was the Art of Medicine found out by the light of Reason; but, Medicine being found, the Reason began to be inquired into.

Ib. Ubi res, &c. Where the Matter is certain, if it be against the common Opinion, the Reason must be sought, and not the Matter of fact scrupled.

Ad pag. 297. Paucissimos, &c. You will find very few of those who dwell at the Spaa who are troubled with the Head-ache, Stone, Obstructions of the Kidnies, Liver, Spleen, or Mesariack Veins; none at all who were troubled with the Jaundice, Dropsie, Gout, Itch, or Falling-sicknesse.

Ib. Inter cetera, &c. Among other Qualities it moveth the Monthly Evacuation as hath been prov'd by a thousand trials. And yet it stops the immoderate Flux of them more happily then any other Medicine.

Ad pag. 299. Rexum, &c. The Contemplation of Nature, though it maketh not a Physician, yet it fits him to learn Physick.

E I N I S.

Mr BOYLE of { Natural and
Experimental
Philosophy.



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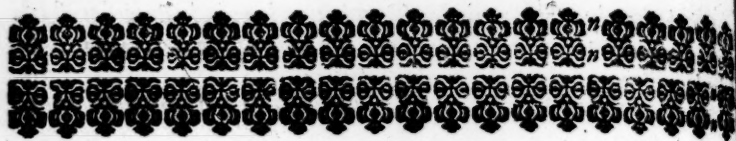
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FINIS.



Reader,

FOr Expedition sake this second Impression was committed to severall Presses, which occasioned the mistake of putting the Pages of the former Impression to the Citations Englished at the end of each part in this: but they being referred to, as well by one or more of the Latin words of each Quotation, as by the Page, and being printed in order as they lye in the Book, thou wilt easily find where each is Englished.

OF THE
VSEFVLNESSE
OF
Natural Philosophy.

The Second Tome.

Imprimatur

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Off. 24. 1670.

SOME CONSIDERATIONS

Touching the
VSEFVLNESSE
OF EXPERIMENTAL
Naturall Philosophy,

*Propos'd in a familiar discourse to a friend
by way of Invitation to the study of it.*

THE SECOND TOME,
Containing the later SECTION
Of the Second PART.

*By the Honorable ROBERT BOYLE Esq;
Fellow of the ROYAL SOCIETY.*

OXFORD

Printed by Henry Hall, Printer to the UNIVERSITY
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CONSIDERATIONS

1682

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THE PUBLISHER

TO

THE READER.



Hereas the Preface of the Noble Author to this *Second Tome* of the Usefullnesse of Experimental Philosophy, written with designe it should come forth a Year or two before the last, it is fit that something be now added about the present Publication.

First, if Inquiry be made, why the *ESSAYS*, that now come abroad, are not accompanied with those others, that according to the *sorts* of the titles, should precede some of them; He represents, That it was not thought fit, that those that are now publish'd, having no necessary dependance on the rest, and being sufficiently intelligible without them, should stay for *Discourses*,

To the Reader,

courses, that are not at present ready, and perhaps will not suddenly be so; *partly*, in regard they consist of no small number of loose Papers, which by reason of some, yet insuperable, obstacles (of which want of health is none of the least) he cannot conveniently seek out, range, and compleat; and *partly*, because he cannot, in the place where He is now detain'd, be master of divers uncommon Minerals, and some Chymical productions, whose Descriptions through haste he omitted, because he had them at hand in the place, where those ESSAYS were written; and presumed, He could at leisure fill up those Vacancies he left for such Descriptions.

Secondly, as to the ESSAYS themselves, which, for the Reasons just now mention'd, come not abroad with the rest, though the Excellent Author hath of late years constantly refused to promise any thing to the Publick, yet that the Reader may the better Judge of the Scope and Designe of the whole treatise, He will not deny him an Intimation of what Subjects those ESSAYS relate unto, by telling him, That *one* of them treateth of the Usefulness of Chymistry (not to Physick, but) to the Empire of Man over the Inferiour Works of Nature: *Another*, of the Advantages that a Naturalist's Country may derive from

To the Reader.

from his Curiosity : *Another* , of the mutual Assistance that the Speculative and Practical part of Physiology may afford each other: After which, comes a Discourse containing inducements to hope for much greater things from *Experimental Philosophy* , than men have hitherto obtained.

Lastly, As to what the Author taketh notice of, about the Coincidence of some Experiments, that may be mentioned as well by Others as by Him ; tis very possible, that the same things may, by the same, or other , ways, come to the knowledge of different persons. Besides, that I have heard Him mention with some complaint, that, when divers years since he writ several Discourses (whereof some belonged to the *Usefulness of Experimental Philosophy*,) for the Use of a private Friend, not for the Presse, he was not so shy, as had been requisite, of *showing* divers Experiments, and of imparting others in discourse , to Inquisitive men, whether English or Forreiners, that came to visit him ; divers of which things he afterwards found in print, sometimes indeed with, but for the most part without, mention of his Name. So that sometimes his unwillingness to disoblige such Writers, and to contend about such matters, made him either wholly omit some of the particulars he afterwards intended to publish , or even to *cross* out several

To the Reader.

several passages, that he had already written, where he would, without much inconvenience (for that did not alwaies happen) either quite leave them out, or substitute others (though less proper) in their stead. He added also, that sometimes observing his Notions and Experiments to be adscribed to other Writers, and somewhat wondring at it, he found indeed such Writers to have mention'd such things, but in *Editions* that came abroad after the publication of our Author's Writings, from whence such things might with the greater likelihood be presumed to have been borrow'd, both because some of the Writers had cover'd with *him*, and he could not find them in the *First* Edition of such Books. But these unfair proceedings being the faults but of a *few*, he said, he was far from imputing them to the *Generality* of those, that have mention'd, (which divers of those have very civilly done,) his Experiments, or writings in theirs.

The Particulars being thus taken notice of, the Curious Reader ought not to be any longer detained from conversing with the Author himself in this Instructive Treatise. Fare-well.



The PREAMBLE.



Have, in the Preface, and Body of the former and already publish'd Part of this Treatise, taken notice of so many of the things, that concerne the whole work in General, that I presume it will not here be necessary to detain the Reader with any other Particulars, than those, that will be offer'd by way of Answers to some Questions, that are like to be ask'd about the Publication of this Present Tome.

And in the first place, If it be demanded, why this Latter part did not more closely follow the former, I have this to Answer, That the Papers it consisted of chanc'd to be so unfortunately dispos'd of, during the late Publick Confusions, that for a great while I was not the Master of them, and in the mean while was, sometimes upon one occasion, and sometimes upon another, engag'd to venture abroad the History of Colours, the History of Cold (with the Preliminary and Additionall Tracts) Hydrostaticall Paradoxes, and the Origine of Formes and Qualities; the Publication of which Treatises, besides that of some Anonymous Papers, as it took up much of the time I had to spare for the Press, so it may, I suppose, keep it from being thought strange, that I did not trouble

*

The Preamble:

ble my selfe and others with this Book also. And indeed, this having been (as the scope and divers Passages of it sufficiently intimate) one of the first I wrote to the Gentleman I call Pyrophilus, I had afterwards occasion, whilst it was out of the way, to make use of so many of the Experiments and Observations, that belonged to it, that fearing I had thereby too much robb'd and disfigur'd it to leave it any way fit for Publick view, I had the greater Temptation to neglect the looking after it.

But if it be further demanded, why then, since it was not ready to come out more early, I did not condemn it not to come out at all? I have two things to returne by way of Answer.

The first is, That some Eminent Virtuosi, to whom I owe a peculiar Respect, were pleas'd to challenge the Edition of this Tome, as if I had made my selfe a Debter to the Publick for the Second Part of this work, by having suffer'd what I wrote to a private Friend to be divulg'd in the first. Especially since the Publick had given that so very favourable an Entertainment; as besides other things, the Early reprinting of it manifested.

The other part of my Answer, and that which made the former Consideration prevalent, is, that I was overcome either by the Reasons, or by the Authority, of those Ingenious Persons, that were pleas'd to think, that this work would not prove unservicable to Mankind, to whose good, both as a Man, and Christian, I have been long Ambitious to contribute, as well upon the account of the Great Author and Divine Redeemer of Men, as of that common Nature whereof all men partake. What the Utilities of this work were conceiv'd to be, the Reader will find disclosed at the end of this Preface. To which I will therefore referre him for an Account of them, and not only take notice, that as to one of the scruples I had against the Publication, namely, That I had plunder'd this present Treasure of divers Particulars; wherewith I had accommodated
some

The Preamble.

Some of my other Writings, I could not well reject this Answer, That in so many years as had passed since the writing of this Book, I had not been so negligent a Commerſer with the works of Nature, and Art, as not to be able to make ſome amends for what I had taken away, and eaſily ſubſtitute other Experiments, and obſervations, to ſupply the vacancies left by thoſe I had transferred to other Diſcourſes.

And as to another of my ſcruples about venturing abroad this Tome, namely, that it muſt come forth ſo late, if it ſhould come forth at all, it was answered, That it could ſcarce come forth more ſeaſonably to recommend the whole Deſigne of the Royal Society, whoſe generous aimes being to promote the knowledge of Nature, and make it uſeſſul to humane Life. This Treatiſe may procure them ſome number of Aſſiſtants in a worke, whoſe Vaſtneſſe and Difficulty will need very many, if mens Curioſity and Induſtry can by this Treatiſe (or any to the like Purpoſe) be well excited by a Conviction of the real and wide diſparity betwixt true Natural Phyloſophy, & that of the Peripatetick Scholes, and that in cultivating the former, they will not meet with a field that will afford them nothing, but (the wonted Production of the Latter) the Thornes and Thistles of acute indeed, but uſeleſſe, and oftentimes troubleſome, Subtletyes; but that they may expect a Soyle that may by a due Culture be brought to afford them both Curious Flowers to gratifie their Curioſity, and delight their ſenſes, and Excellent Fruites, and other ſubſtantiall Productions to answer the Neceſſities and furniſh the Accommodations of Humane Life.

And I will not deny, that I have had the fortune to be looked upon, as not the unfiteſt Perſon in the World to offer ſomething in this kind, For thoſe that are meer Scholars, though never ſo Learned and Criticall, are not wont to be acquainted enough with Nature and Trades, to be able to ſuggeſt thoſe Inſtances, that are the moſt proper to manifeſt that, which men are to be convinced

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convinc'd of. The meer Chymists, besides that their Curiosity in wont to be too much confin'd to let them be fittest for such a work, have the ill fortune to be distrusted by the Generality of men, not Credulous, which is a great unhappinesse in this case, because that though their Experiments were never so true (as divers of them are) yet skill in their Art being requisite to make them, mens diffidence of the Proposers, joyned with the difficulty of examining the things, will not allow them, either to Believe what is proposed, or to Try it. And as for the New Philosophers (as they call them) though, if they were to write but for Philosophicall Readers, I know several of them, that would questionlesse do it rarely well, yet the generality of those Readers to whom we would give good Impressions of the study of Nature, being such as will probably be more wrought upon by the Variety of Examples, and Easy Experiments, than by the deepest Notions, and the neatest Hypotheses, such a Treatise for the kind, as that which follows, containing many Practises of Artificers and other Particulars, that are either of easy Tryal or immediate Use, may perhaps by that Variety gratifie, and perswade a greater number of differing sorts of Readers, than a farre more Learned and Elaborate Piece, that might be welcomer to more intelligent and Philosophicall Perusers.

If it be askt by Some that know me, Whence it comes, that the Second part of the Usefullness of Experimental Philosophy being written (as very credible Persons that saw it can witnesse) about the year 1658. there may be met with in the following Treatise some Experiments of my owne, that they know were since made, and some (though few) Citations out of Books publisht since that time? If I say this be askt, the Answer is intimated a little above; For having transferr'd to other Tracts many passages that belong'd to those I now publish, I was oblig'd to repaire the injury I had done them, by supplying them with such Particulars as

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offer'd themselves to my memory when I hastily review'd this
Tome, without scrupulously minding the times, when the
Particulars inserted did first occurre. And if this Adver-
tisement be apply'd to some other of my Writings, that ei-
ther the importunity of Friends, or some unwelcome Acci-
dents, engag'd me to publish out of their due time, and not
in their intended order, it may keep men from thinking,
that when I first wrote them, I had read over, or at least
seen, (which indeed I neither did nor could) every Book
of a recenter Date, of which upon occasion I mention a
Passage or two, and those perhaps as they are cited by other
Authors, we being here in England but slenderly and very slowly
furnish'd with modern forrein Books.

All these inserted passages the Reader should find included
in Paratheses (as the Printers call these marks []) by which
he will yet be able to distinguish severall of them, though I
now find, that some others by the negligence of the Transcribers
or of the Press or of Both have bin omitted, which Advertise-
ments I feare may have need to be extended to some other prin-
ted Tracts of mine, wherein Paratheses are to be met
with.

Bating these few additionall passages, the insuing Booke
comes forth without taking notice of what changes or disco-
veries have happened in the Common wealth of Letters, since
the time it was written in. On which account, if some few of
those many particulars deliver'd there should chance to be co-
incident, with what some other man hath written, I would
neither on the one side be thought a Plagiatary my self, nor on
the other side deny any man, to whom it may be due, the honour
of the earliest Publication, though, to shun needless Contro-
versies, I am somewhat shy of naming this or that Person, as
the first Proposer or inventour of an experiment, which (especi-
ally if the persons or things be not considerable) is often diffi-
cult enough to discover, witness the contests that have bin, and
yet

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yet continue, about the first Inventors of Common weather glasses, the Ascension of water in slender Pipes, the glass drops that fly in pieces, the measuring of time by a Pendulum which is more strange, the art of Printing it self. If it be ask'd why I did not forbear to make use of some Practises of tradesmen and other known, and perhaps seemingly triviall, Experiments. These things may be replied,

1. That since on divers occasions it was requisite, that my discourse should tend rather to convince than barely to inform my reader, it was proper, that I should imploy at least some instances, whose truth was generally enough known, or easy to be known (by making inquiry among Artificers) even by such as out of laziness, or want of Skill, or accommodation cannot conveniently make themselves the tryals.

2. But yet, I have taken care, that these should not be the only, nor yet the most numerous instances, I make use of: it being in this Tome, as well as in my other Physiologicall writings, my main businesse, to take all just Occasions to contribute as much, as without indiscretion I can, to the history of Nature and Arts.

3. As to the Practises and observations of Tradesmen, the two considerations already alledged, may both of them be extended to the giving of an account of the mention I make of them. Of the truth of divers of the Experiments I alledge of theirs, one may be easily satisfied by inquiring of Artificers about it, and the particular or more circumstantial accounts I give of some of their experiments, I was induc'd to set down by my desire to contribute toward an experimental History. For I have found by long and unwelcome experience, that very few Tradesmen will and can give a man a clear and full account of their own Practises; partly out of Envy, partly out of want of skill to deliver a relation intelligibly enough, and partly (to which I may add chiefly) because they omit generally, to express either at all or at least clearly some im-

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important circumstance, which because long use hath made very familiar to them, they presume also to be known to others: and yet the omission of such circumstances, doth often render the Accounts they give of such practices, so darke and so defective, that, if their experiments be any thing intricate or difficult (for if they be Simple and easy, they are not so liable to produce mistakes) I seldom thinke my self sure of their truth, and that I sufficiently comprehend them, till I have either tryed them at home, or caused the Artificers to make them in my presence.

They that have given themselves the trouble of endeavouring to make the experiments of Tradesmen, to be met with in the writings of Cardan, Weckar, and Baptista Porta for instance, and have thereby discovered (what is not usually obvious upon a transient reading) how lamely and darkely, (not to add unintelligibly) severall things are written, will probably afford me their Assent, having found upon tryal the instructions of such learned and ingenious men, to be often obscure and insufficient for practice.

But here I must give the reader notice, that as Mechanical Artes for the most part advance from time to time towards perfection, so the Practices of Artificers may vary in differing times, as well as in differing places, as I have often had occasion to observe. And therefore I would neither have him condemn other writers or Relators, for delivering accounts of the experiments of Craftsmen differing from those I have given, nor condemn me, for having contented my self to set down such Practices faithfully, as I learn't them from the best Artificers (especially those of London) I had opportunity to converse with.

But here perhaps it will be demanded by way of objection, whether I doe not injure Tradesmen by discovering so plainly those things, which our Laws call the Mysteries of their Arts. To a question, that may perhaps by some be clamorously pressed,
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not only upon me, but much more upon Some ingenious men of our Nation, whose pens have bin more bold than mine in disclosing Craftsmens Secrets, 'twill be requisite to returne severall things by way of answer, but that such Readers as are not troubled with the Scruple, may not be so with the Apology, they will find this printed in another character, so that, if they please, they may pass it over unread.

First then, It may be represented, that I never divulge all the Secrets and practices necessary to the exercise of any one Trade, contenting my self to deliver here and there upon occasion some few particular Experiments, that make for my present purpose: So that, for much more than I allow my self to doe, I can plead the example, not only of other writers, that have published Books to teach the whole Mystery of this, or that trade, as the Priest *Antonio Neri* hath diligently done in his Italian *Arte Vetraria*, and some English, as well as forreign, Virtuosi have done on other Subjects; But also some of the Artificers themselves, as the famous Gold-smith and Jeweller *Benvenuto Cellini* in his much esteemed Italian Tracts of the Lapidaries and Goldsmiths Trades. Thus also the famous Mineralist *Georgius Agricola* published in Latin a whole Volume of the more practical part of Mineralogie, wherein he largely and particularly describes Experiments, tooles, and other things that belong to the Callings of *Mein men*. To which I might add divers other Treatises, some of them French, others Italian, (which, though I could not procure them, I have seene among curious collections of books) that have bin published about Severall Artes by the Artificers themselves. And 'tis notorious, that in English, as well as in divers forreign languages, we have Books of the Artes of Gunnery, Distillation, Painting, Gardening

&c.

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the divulg'd by persons, that Professed those Callings.
Secondly, it is not the Custome of Tradesmen to buy Books, especially such as are not intended for such Readers, and treat (for the most part) of things either beyond their reach or wherein they seem not likely to be concerned; And as for Gentlemen and Scholars, though some of them may, to satisfy their curiosity, make a few tryalls, yet their doing so will scarce in the least be prejudicial to Tradesmen. Since (to omitt other Arguments) it will not be worth while for a Virtuoso to be at the charge and trouble of buying tooles, and procuring other necessary accommodations to sell a few productions of his skill, though he should not scruple to descend to such a Practice. For if he make but a small number of Experiments, their effects will cost him more than the like may be bought for, of those that make them in great Quantities, and whom their trade obligeth to be sollicitous to buy their instruments and materials at the best hand, and sell them to the best profit. Besides that most of the workes of Artificers, are chiefly recommended to the more curious sort of buyers by a certain politenesse, and other ornaments (comprised by many under the name of *Finishing*) which require either an instructed and dexterous hand, or at least some little peculiar directions, which I did not allwayes thinke my self oblig'd to mention, in a treatise designed to assist my friend to become a Philosopher, not a tradesman, and publish'd to help the Reader to gain knowledge not to get mony.

Thirdly, to publish an Experiment or two, or in some cases a much greater number belonging to a Trade, is not sufficient to rob a Tradesman of his Profession. For, besides that most trades consist of Severall parts, and are each of them made up of divers Practices (that commonly are more than a few) Those numerous Mechanicall Arts,
that

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that are called handicrafts, require (as their very name argueth a Manuall dexterity) not to be learnt from Bookes, but to be obtaind by imitation and use. And to these considerations I shall add this more important one, that Mechanicall professions are wont to be as it were made up of two parts, which, for distinction sake, I take leave to call the *Art* and the *Craft*; by the former whereof I mean the skill of making such or such things, which are the genuine Productions of the Art, (as when a Taylor maketh a suit, or a cloak,) and by the latter I mean the result of those informations and Experiments, by which the Artificer learns to make the utmost profit, that he can, of the Productions of his Art. And this Oeconomical Prudence is a thing very distinct from the Art it self, and yet is often the most beneficial thing to the Artificer, informing him how to chuse his materialls and estimate their goodness and worth, in what places, and at what times, the best and cheapest are to be had, where, and when, and to what persons the things may be most profitably vented. In short, the Craft is that which teacheth him how both to buy his materialls and tooles, and to sell what he makes with them to the most advantage.

Fourthly, it may often prove more advantageous than prejudiciall to Tradesmen themselves, that many of their practices should be known to Experimentall Philosophers. This I suppose that I have sufficiently proved in some, and especially in * one of the following Essayes.

* The Essay here meant is that which treats of the Utility of the Naturalists insight into trades.

Yet I shall now represent, that though some little inconvenience may happen to some Tradesmen by the disclosing some of their Experiments to practicall Naturalists, yet that may be more than compensated, partly, by what may be contributed to the perfecting of such experiments themselves, and, partly by the diffused Knowledge and sagacity

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city of Philosophers, and by those new Inventions, which may probably be expected from such persons, especially if they be furnished with Variety of hints from the practices already in use. For these Inventions of ingenious heads doe, when once grown into request, set many Mechanical hands a worke, and supply Tradesmen with new meanes of getting a livelyhood or even enriching themselves: As to the discipline subordinated to the pure Mathematicks, this is very Evident, for those speculative Sciences have (though not Immediately) produced their trades that make Quadrants, Sectors, Astrolabes, Globes, Maps, Lutes, Vials, Organs, and other Geometrical, Astronomical, Geographical, and Musical instruments; and not to instance those many Trades, that subsist by making such things as Mechanicians, proceeding upon Geometrical Propositions, have bin the Authors of; we know that whether the excellēt Galileo was or was not the *first* finder out of Telescopes, yet he improv'd them so much, and by his discoveries in the heavens, did so recommend their usefullnesse to the curious, that many Artificers in divers parts of Europe have thought fit to take up the Trade of making prospective glasses. And since his death, severall others have had profitable worke laid out for them, by the newer directions of some English Gentlemen, deeply skill'd in Dioptricks, and happy at Mechanical contrivances; in so much that now we have severall shops, that furnish not only our own Virtuosi, but those of forrein Countreyes with excellent Microscopes and Telescopes, of which latter sort I lately bought one (but I confesse the only one that the maker of it, or any man, that I hear of, hath perfected of that bignesse) which is of threescore foot in length, and which the Ingenious Artist, that made it Mr Reeves, prized constantly at nolesse than an hundred pounds (English mony) I know

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not, whether or no I should add, that possibly some particular experiments of mine have not bin hitherto unprofitable to severall Tradesmen: But this I may safely affirm, that a great deal of money hath bin gained by Tradesmen, both in England and elsewhere upon the account of the scarlet Dye, invented in our time by Cornelius Drebbell, who was not bred a Dyer nor other Tradesman. And that we dayly see the Shops of clockmakers and watchmakers more and more furnished with these usefull instruments, *Pendulum Clocks*, as they are now called, which, but very few years agoe, were brought into request, by that most ingenious Gentleman, who discovered the new Planet about Saturn.

I have handled the Subject of the foregoing Arguments much more particularly, than I would have done, had not my pen bin draw'n on, by a Hope that the things I have represented may furnish Apologies to many inquisitive men, who may be thereby embolden'd to carry Philosophical materials from the shops to the Scholes, and divulge the experiments of Artificers, both to the improvement of trades themselves, and to the great enriching of the History of Artes and Nature.

If it be further demanded, whether I have furnished these Essayes with the chiefest things I could have afforded them, I must confesse, that I have not, for though I had lying by me Severall Experiments and observations, less inconsiderable than many of those I have made use of, which would have bin pertinent enough to the Subjects here treated of, yet I purposely forbore to imploy them in these tracts, because I would not defraud those others, to which they were more proper, & some of them necessary. For I freely declare, that my designe in this present Tome was not to furnish it as well as I could,

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but to preserve, as in a repository, several scatterd Experiments and Remarks, which I could best spare from the other Treatises I had design'd, which might otherwise probably be lost; but yet I shall not deny, that I did not carelessly draw up some of the following Tracts, but that I endeavourd to write them in such Methods, that they might contain severall distinct heads, and those as comprehensive as I could easily make them, that both the young and hopefull Gentleman I call Pyrophilus, and I my self might conveniently refer such other practices and experiments (especially those of Tradesmen) as should hereafter occur to us, and appear to belong to those heads. And I did the lesse despair of his giving a kind reception to these discourses, because I could expect so little assistance in my undertaking, having never met with any booke, great or small, written upon the subject I was to treat of.

If hereupon it be objected, that by my own confession, divers of the particulars admitted in to this Booke are but slight, and some of them already known, I shall represent, that as some of the Experiments spoken of are but slight, so there are others, that possibly discerning Readers will not thinke to be altogether such, and that 'twas fit (for reasons already mention'd in this very preface) that I should not forbear to imploy, as prooffes to convince others, things either known or easy to be made so, especially since I commonly use them to some purpose or other, whereto they have not been applyed, and my design in the publication of these trifles being chiefly to invite the generality of Readers, though of different inclinations, Qualities, &c. to addict themselves to the study of experimental Philosophy. The variety and easiness I have aim'd at in the experiments I have set down, may for ought I know, be more proper, than if I had confin'd my self to the mention of a few choise and Elaborate experiments, which some Readers would think impertinent to their studies, and

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and others judge too difficult for them to put in practice. It appear'd not unfit, that a book, whose title was like to procure it very different sortes of Readers, should be for the most part written in a popular way; divers persons, especially those of a higher Quality, by a trifle that hath the luck to gratify their curiosity, may be more successfullly invited to relish and esteeme experimental learning, than by a deep notion, or a weighty experiment. And there are others, that will easilier be brought to value and try experiments, by meeting with some few, though but slight ones, that happen'd to suit with their humour or calling, or to accommodate them on some particular occasions, than they would by many others, much more luciferous, or otherwise important. And though were to be wished, that mens Kindnesse to Practical Philosophy were grounded on the best motives, yet this Treatise will not altogether misse the Aim of its Publication, if even upon the foremention'd Slighter Accounts, it engages Readers to make as well as relish experiments; for the pleasantness, variety, usefullness and other indearing Qualities of such an employment, will probably invite most of them to a further progress, whereby many usefull Phenomena and observations are like to accrew to what is allready known of the History of Nature and Arts. And if this shall come to pass, it will keep him from complaining of Labor lost, who in venturing upon such a worke as now comes forth, was knowingly to postpone the appetite of fame to the Desire of doing some service to mankind; to which end he takes one of the directest wayes to be the contributing somewhat to the Advancement of Experimental Philosophy.

It remaines, that I add something more, which possibly may not a little befriend both these last mention'd Answers, and severall others contain'd in this preface, for, when all the former demands occur'd to my thoughts, as likely to be made, some by one sort of Readers, and some by another, those

Virtuosi,

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virtuosi, that were solicitous for the Publication of these Papers, were not backward to urge the utilities, which they fancied would thence accrew to the publique. And I cannot very well deny, that, as meanly as I thinke of a Treatise to whose first Tome I did not, till the second Edition, (when I could conceal it no longer) let my name be prefixt, yet such a worke as this for kind well perform'd, may be a very usefull one. And even of this following book, such as it is, it was suggested, that the uses would not prove despicable, in regard that beside those, that are Common to It with the formerly published Tome, such as the improvement of the minds of men, and (especially) the assisting them to understand the Workes of God, and thereby engage them to admire, praise and thanke him for them. Besides these (I say) there may be other uses of the following Tome, which, to avoid increasing a prolixity, that I feare is already too great, I shall rather name than discourse of, contenting my self briefly to intimate, that 'twas conceiv'd the peculiar uses of this present Tome might be such as these.

I. It may afford Materialls for the History of Nature, which that it may the more plentifully do, I have purposely on severall occasions added a greater number of Instances, than were absolutely necessary, for the making out of what I intended to declare or prove.

II. It may afford some Instructions, Advices, and Hints to promote the Practicall or Operative part of Naturall Philosophy in divers particulars, wherein Men have been either not able, or not solicitous to assist the Curious.

III. It may enable Gentlemen and Scholars to converse with Tradesmen and benefit themselves (and perhaps the Tradesmen too) by that conversation; or at least, it will qualify them to ask questions of Men that converse with Things; and sometimes to exchange Experiments with them.

IV. It may serve to beget a Confederacy and an Union
between

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between parts of Learning, whose possessors have hitherto kept their respective Skills strangers to one another; and by that means may bring great Variety of Observations and Experiments of differing kinds into the Notice of one man, or of the same persons; which how advantageous it may prove towards the Increase of knowledge, our Illustrious Vernalam has somewhere taught us.

V. It may contribute to the rescuing Naturall Philosophy from that unhappy Imputation of Barrenness, which it has so long lain under, and which has been, and still is, so prejudiciall to it. And to effect this Rescue, it will in some measure enable those that desire it to employ those practick Arguments, that are proper to convince many that are not to be convinc'd by any other sort of Prooves.

VI. And which is the main of all, it may serve by Positive Considerations, and Directions, to rouse up the Generality of those, that are any thing Inquisitive, and both loudly excite and somewhat assist the Curiosity of mankind, from which alone may be expected a greater progress in Usefull Learning, and Consequently greater Advantages to men, than in the present state of Humane Affairs will be easily imagin'd.

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OF THE
VSEFULNESSE
OF
Experimental Philosophy.

The SECOND PART.

The SECOND SECTION.

Of its Usefulness to the *Empire of*
Man over inferior Creatures.

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ESSAY I.

Containing some general Considerations about the Means, whereby Experimental Philosophy may become useful to Humane Life.

Hitherto, my Dear *Pyrophilus*, I have attempted to satisfy You of the Usefulness of Experimental Natural Philosophy to Physick: it followes, that I proceed to endeavour to shew you, that it may be also very serviceable to Husbandry, in all its subordinate parts, and to those other Professions that serve to provide Man with Food or Rayment, or do otherwise minister to the Necessities or Accommodations of Life; as the Trades of Brewing, Baking, Fishing, Fowling, Building, and the rest not needful here to be enumerated. For though the Humane Body, in respect of the Rational Soul, (which is the Inventress and Seat of Sciences) be one of the Corporeal things, over which the Empire of Knowledge is to be establish'd; yet taking Man as a Creature made up of Body and Soul, the Advancement of his Empire seems to consist more properly in the Inlargement of his Power over the other Creatures: Physick seeming rather to defend him against Revolts and Insurrections at home, than to increase his Power, and extend the Limits of his Empire abroad.

But, *Pyrophilus*, I hope You do not expect, that I should now *insist* on each, or so much as on any of the above mention'd Trades, by whose intervention tis, that Man exercises his Dominion over external Bodies. For such a work would

require little lesse than an Age, and much more than a Volume; and besides (that it is vastly disproportionate, both to my slender stock of Mechanical skill, and to the little leasure I have to conclude this Section in) I could not acquaint you with all that I could pertinently enough deliver about these matters, without too much defrauding some other Treatises that I design You: and therefore I hope you'll be content, if, in the remaining part of this Tract, I do *not only* present you a not despicable number of Considerations proper to manifest *That*, and to intimate *How* Experimental Philosophie may be of great Use to the promoting of Mechanical Arts and Trades, *but* illustrate and confirm all, or most of those Considerations by particular Instances, deriv'd from Observations and Experience.

This I shall, God assisting, endeavour to do in the following Essays. But before I descend to particulars, it will be expedient in this place to premise some general Considerations relating to the influence of Experimental Philosophie upon Trades, and two or three Advertisements, that concern the ensuing Discourses.

THE I. SECTION.

First then, to make it probable, that a true insight into Natural Philosophie may be capable of affording some reformation, or other kind of improvement to Trades, I shall desire You to consider, That being, for the generality of them, conversant about some few particular productions of Nature, such Men as are thoroughly skill'd in her general Laws, and acquainted with a vast number of her Productions, and vers'd in the wayes of applying Nature and Art jointly to several purposes, according to the several Exigencies of things, such sagacious persons (I say) will, in all likelihood, be able some way or other, to meliorate the Inventions

ventions of illiterate Tradesmen. As the Husbandman's skill, for instance, consisting chiefly in the Observations of the Nature of a few Plants and Animals, their relation to such and such Soils and kinds of Culture, and the Operations of Stars and Meteors upon them, which are Subjects that properly enough fall within the cognisance of the Naturalist, it cannot seem improbable, that He that has seriously and industriously enquir'd into the Nature of Generation, Nutrition, and Accretion, both in Plants and Animals, and knows how to vary an useful Experiment, when once found out, so as to remedy the inconveniencies, or supply the deficiencies, or improve the advantagioussesse, or translate and apply the use of it, and (in summe) He that can knowingly and dexterously manage, what his own and other mens Observations have afforded him, will be able to cultivate the ordinary Husbandman's skill with as much improvement, as that confus'd skill enables the Husbandman to cultivate his Ground.

THE II. SECTION.

TO carry on the foregoing Considerations a little farther, I will adde, That it may as well conduce much to the manifesting how much Trades are subordinate to Natural Philosophie, as to the improvement of Trades themselves, that it be attentively consider'd, what things each particular Trade is, as it were, made up of. As, for Example, the chief things in the Refiners Trade are, To know the wayes of making, and the Operations of *Aqua fortis* upon Silver, Gold, and Copper; to know how to purge that *Menstruum*, that it may dissolve no Gold, nor precipitate any of the Silver it dissolves; to know what proportion there ought to be dissolv'd in it; to know with what quantity of Water to weaken the Solution, and how long Copper plates need lye in.

in it, to precipitate all the Silver out of it, *to know how* Lead is to be colligated with them, and *what proportion* of it is necessary and sufficient to carry off with it (when it is blown off upon the Test) the baser Metals; *to know how* to make Cupples of several sorts and sizes, and upon them *to draw off* the Lead or Antimony from the Silver or Gold, and discern when the Metal is sufficiently refin'd; *to know* what proportion of Gold and Silver is requisite for the making of *Water-Gold*, as they call it, (because it is separated from Silver by *Aqua fortis*, which dissolves this Metal, and leaves the other in a fine powder;) These things, to which many others are subservient, belong to the Refiners Trade, which, though understood by few, seems to be a very narrow and simple Trade, in comparison of a hundred others, whose Operations are far more numerous and complicated. Now if all Trades were judiciously resolv'd (if I may so speak) into the several parts they consist of, it would, I question not, manifestly appear, that the most, if not all of them, are in many particulars but *Corollaries* deduc'd from some particular Physical Observations, or but Applications of them to the uses of Humane life.

And if this be so, you will not, I presume, think it unlikely, that by a farther discovery of the Nature of those particular Bodies wherewith the Trade is conversant, and a solid knowledge of those Laws of Nature, and those Operations of Bodies upon one another, which it employes, some, if not most, of those parts, whereof the Trade may be conceiv'd to be made up, may be reform'd or better'd, which is enough to make the Philosopher an Improver of the Trade, which he may become upon such unobvious accounts, that perhaps it may not unreasonably be hop'd, that even the Chymist's Charcoal may be made by a good Naturalist equivalent to an excellent Compost for Land. For if it be true, as well as tis probable, not onely that the Food of those Animals (as

Oxen,

Oxen, Sheep, &c.) which the Husbandman deals with, springs out of the Ground; but that the Plants, which afford them this food, are themselves nourish'd by a certain vegetative Salt they find in the Ground; and that this Salt being by frequent Seminations exhausted, the Soil grows barren, *either* by the Air, *or* the steams of the subterraneous parts, *or* the spontaneous Maturation of the Saline Rudiments contain'd in the Ground, *or* by adventitious Manure, *or* by all *or* diverse of these together, it be re-impregnated with a new vital Saltneffe: if these things be true, I say, then those Chymical Experiments, that conduce to discover to us what kind of Salt that is, and to what other Salts it is allied or opposite, as tis to several Acid ones, may probably afford very useful Directions to the Husbandman towards the meliorating of his Land, both for Corn, Trees, Grass, and consequently Cattel. And having had the Curiosity to distill some Earths, some Dungs, and some Seeds, and observe the Salts abounding in the Liquors yeilded by them, (of which we have elsewhere occasion to speak) we found cause to wish, that Experiments of that nature, in relation to the improvement of Husbandry, might be industriously prosecuted by Naturalists. He that has observ'd those many particulars in Husbandry, which might invite that great Naturalist Sr. F. Bacon (who yet mentions very few of them) to pronounce that Nitre is, as it were, the life of Vegetables; he that observes how conducive that fertilizing Dung of Pigeons is, both to make Earth fruitful to the Husbandman, and to impregnate it with Nitrous Salt for the Salt-perre man; and he that knows that moist fat Earths, so defended from the Rain and Sun, that the one may not draw up, nor the other wash down the Embrionated Saltneffe of them, will after a time abound in Nitrous Salt, if they are not permitted to spend any in producing of Vegetables;

such

Verulam Hist. v. & Mort.
pag. 237. Certissimum est
quancumq; terram, licet param,
neq; Nitrosi admixtam, ita
accumulatam & lectam, ut im-
munis sit Solis, neq; emitat
aliquid vegetabile, colligere eti-
am satis copiosè Nitrum.

Nat. Hist. Cent.
5. Exp. 444.

such a one, I say, will perchance be apt to think, that Enquiries into the Nature of Salt-petre may be of great concernment to Husbandry. And to give you, *Pyroph.* some Inducements to expect that Chymistry may be very useful in such kind of Enquiries, I shall here mention to You a couple of my Experiments relating to Nitre.

The first is that, whereby I endeavour'd to give an inquisitive Person hopes, that Materials which seem'd unlikely, might, by due changes, and without much Art, be turn'd into Salt-petre. The Experiment was this. I caus'd some Earth to be digg'd up just underneath the Clay-floor of a Pigeon-house, such Earths being believ'd to abound the most with Nitre, that needs onely to have its Particles brought together and united to compose Salt-petre; a pretty quantity of this Earth being put into a Retort, and distill'd with a good fire *ex Arena*, afforded me though little or no Oyl, yet a pretty quantity of a reddish Liquor, which, in stead of being, as others would have expected, of an acid Nature like Spirit of Nitre, was fit for my purpose, by strongly participating of the Nature of Volatile Salts; as appear'd, not onely in that I could without rectifying it, turn Syrup of Violets with it immediately green, and precipitate a Solution of Sublimate into a Milky substance: but because there came over with the Spirit into the lower part of the Receiver, a Salt in a dry form, which not onely was in Tact not unlike other volatile Salts, but was so far from being of an acid Nature, that with an acid Menstruum it readily fell to hiffe, and made an Ebullition. So that it seems (which in an Enquiry about Nitre is very considerable,) that a Salt, very repugnant to Acids, may, by the Operation of the Earth and Air, be so alter'd, as afterwards by a slight management to afford Salt-petre, whose Spirit is highly acid. But of this Experiment I may hereafter make farther mention.

The other, (which we elsewhere have occasion more particularly to take notice of with Reflections on it) is briefly this. We took Pot-ashes, which you know contains but the Salt of burnt Vegetables; and on those, first dissolv'd in a little fair Water, we dropt *Aq: fortis* (whose Saline part consists indeed of little else than the Spirits of Nitre,) till all Ebullition and Hissing betwixt It and the resolv'd Pot-ashes were perfectly ceas'd; and having filtrated this Liquor, and set it in an open Vessel in a gentle heat to evaporate, it did within two or three dayes after, (and sometimes, for we made it more than once, even in a few hours,) being remov'd to a cold place, afford us very pure Chrystals of Salt-petre, as both their shape, and flashing (on live Coals) into a blew halitious flame, inform'd us. And since I have had occasion to mention the Use of Salt-petre in Husbandry, I shall not forbear to adde, That the knowledge which the Naturalist, as a discerning Chymist, may give the Husbandman of the natures and distinctions of Saline Bodies, may be of no mean use to him, by assisting him to discern and observe the considerablest differences of the various Saltnesses to be found in Soiles, and what sort of Saltness each particular Seed or Plant most affects. For by this means, not onely many Grounds might be made useful, which are thought barren, onely by reason of our not knowing for what Plants the Saltness predominant in them may be proper, but the same Ground may yeild much frequenter Crops than commonly it doth, when it is successively sow'd onely with one sort of Seed, by the due alteration of Plants delighting in the several sorts of Salts, to be met with in that Ground, which oftentimes, by being impoverish'd, or rather freed from one sort of Salt, doth but the more plentifully feed those Plants that delight in another: which in some places we have observ'd that Husbandmen seem to have taken notice of already, by sowing (in fields too remote from their Dwellings to have

Compost brought to them) Turnips, to fit the Ground for Wheat, and serve for a Manure, though in this method some other Circumstances may possibly concur with the nature of Turnip-feed, to the preparation of the Ground for Wheat. And I am prone to think, that there is scarce any Ground or Soile, (except perhaps meer Sand) that might not, even without much Culture, be made fertile, or at least kept from being altogether barren, if we were on the one hand skill'd in the wayes of discerning the Nature of the Ground; and on the other hand acquainted with, and provided of, all the variety of Seeds and Plants that Nature has (though not all in one Countrey) afforded us. For there are divers Soiles, which here in *England*, or in other Regions, are, as uselesse, left quite uncultivated; which, Seeds or Plants, that abound in other Countries, and would probably be made to grow in these, would make serviceable to the Husbandman. Many steep and abrupt portions of Ground (some of them very large) expos'd to the Southern Sun, are left altogether wast, not onely in *England*, but in divers hot Climates, where the planting of Grapes for Wine is not yet in use; though such pieces of Land in *France* and *Italy*, and (as I have observ'd) even in the *Rhetian* Alpes, nourish excellent Vineyards.

I know an ancient and Landed Gentleman, who communicated to me upon his own knowledg an experienc'd way of making Wheat grow and prosper well on meer Clay, where there was no Grain at all did thrive: which though I have not hitherto had opportunity to try, yet upon the credit of a Person so sober and qualified, I scruple not to mention it here, because the Art consisting mainly in the Imbibition of the Seed for a determinate time in a certain express'd Oyl that is not dear; it may make it probable, that without altering the whole Soile by Manures, a slight, but convenient change made in the Seed it self, may serve to make them fit

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for one another. And (to adde that upon the by) to shew that the particular dispositions of some sorts of Seeds may enable them to make the Ground they are sow'd in, much more productive than it would otherwise be, I shall relate to you, that being not long since in the Company of a Learned and Curious Traveller, I saw, among some Rarities of a quite other nature, an Ear or two of Corn, not much unlike our common Wheat, at which being somewhat surprized, I askt him what peculiarity had procur'd that Grain admission among such Rarities? To which he replied, That in the warmer Region where he begg'd it of a *Virtuoso*, one of those Grains would afford so vast a multitude, as he was almost ashamed to name, and I am more than almost afraid to repeat: but before I went out of the house, an English Gentleman, that had a more than usual Curiosity for such kind of Trials, assur'd me, that having obtain'd some Grains of that Corn, and carefully sow'd it in some Land of his own, not far from the place we were in, he had out of a single Grain several Hundreds; though not near so many of them, as the other Traveller, who yet was a very sober and judicious man, related to have been produc'd in a better Climate and Soile. Of this strangely prolifick Wheat, the Gentleman readily granted me a promise of a sufficient quantity to make a Trial, whereof, when I shall have receiv'd it from a Servant of mine in the Countrey, You may command the Success. And this brought into my mind what I read in the Learned Jesuite * *Acosta*, who affirms, that in divers parts of *America*, where tis known that our *European* Wheat prospers not, the *Indian* (or, as many *English* have stil'd it, *Virginian*) Wheat they call *Maiz* does so wonderfully thrive, that although the Stalk bear often more than one Cluster, and the Grain be big; yet in some Clusters he has reckon'd seaven hundred grains: to which he addes, *That it is not strange in those countries to gather three hundred (Fanegues, or) measures for one*

* *Lib. 4. Cap. 16.*
as he is published
by Purchas.

sown. Which passages, especially the former, speak of an Increase that seems so little Credible, that I should on that account forbear to mention it, were it not that in *Europe*, and even in *England*, I my self have reckon'd such a multitude of Grains upon one of the very numerous Ears produc'd by the same single Grain, that I found my self very inclineable to absolve *Acosta*, and continue to look upon him as one of the best Writers of the Natural Historie of *America*.

We now proceed to take notice, that in some Eastern Countries, a sort of Rice (a Grain that makes the chief and most usual food of the Natives over almost all those parts) prospers very well upon Land so drencht with Waters, that Seeds-men, to scatter the Rice, do rather Wade than Walk. But this it self (which, for the main, was confirm'd to me by Eye-witnesses) is lesse strange, and does lesse illustriously confirm what I was proposing, than what the inquisitive Jesuite *Martinius* affirms to be the practice of some (as well great as small) Countries in *China*, where, in divers places that are all the year under water, and would by our *European* Husbandmen be thought capabable of no other use, than that of Ponds or Lakes, the *Chinenses* cast a certain Seed so well appropriated to the place that is to receive it, that though it falls not immediately on the Land but on the Water, (so that one would think they were not about to sow a Field, but bait a Pond for Fishes) yet this Seed, being adapted to the Soile it meets with at the bottom of the water, does so well prosper and shoot up to the top, that in its proper Season the surface of the Water looks as fresh and verdant as a fruitful Meadow, and yeilds as rich a Crop. But for fear of digressing, I shall, *Pyrophilus*, proceed to tell you, that perhaps also Chymistry, especially in conjunction with Hydrostaticks, may prove serviceable to the ingenious Husbandman, by assisting him to discover the kinds and degrees of Saltinesses, that are in several other Bodies that he much

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deals with. I remember I have met with things surprizing enough, in examining some sorts of Earths by Distillation, and by several Chymical Instruments of Discovery; but though I have likewise had the Curiosity to distill Dungs and Grain, and Fruits, and some other Subjects, wherewith the Husbandman is conversant, to observe what kinds of Saline and other Liquors, and in what proportion, and of what strength, they could afford me; yet not having any Notes by me of the particular Trials, I shall content my self to have given you this hint of a new sort of Experiments in Husbandry, and shall onely adde, as to Salts, That since the fertilizing power of Dungs seems to reside in the Salino-sulphureous part of them, (and the like I have by Chymical Trials found in Lime;) a practical insight into the differences and differing Operations of Salts (about which I elsewhere entertain you) may probably very much assist the Husbandman to examine the several Dungs, and other Composts, (the knowledg of which is of great moment in his Art,) and to multiply, compound, and apply them skillfully.

And as Chymistrie, that is conversant about Fire; so even Hydrostaticks and Hydraulicks, that teach us to make Engines and Contrivances for the lifting up, and for the conveying of Water, may in divers places be of no small use to the Husbandman. For not to mention what is done in some more known parts of the East, of the like nature with what I am going to mention, *Martinus* informs us, That in one Province of *China* (whose Name I remember not) they are so curious to water their Fields of Rice, that they have upon the River excellent Mills so made, as that great quantities of Water are continually rais'd in Buckets, or other convenient Vessels, fastned to vast Wheels driven by the stream; which watering-Mills (to add that notable Instance upon the by) are not (as our *European* Mills are wont to be)

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fixt to one place, but built upon Vessels, with which they may remove the Mills, how great soever, from place to place, as occasion requires. Nor is this Eastern way of raising Water by Wheels, so as that it may be conveyed by convenient Channels to places many foot higher than the River, or other Receptacle of the Water that is to be distributed, the onely way whereby the Hydraulist and Mechanician may assist the Husbandman, since he may considerably do it by the Art of Libellation, or conducting of Water upon the Ground. For the Improvement that may be made of Land by water, *in Soils fit for that way of Culture*, may be far more considerable than is yet wont to be taken notice of, (as indeed this Husbandry it self is in many Countries both elsewhere, and in *England*, as yet unpractis'd.) I have had some Lands of my own much better'd by being skilfully overflown, so that when I observ'd the difference, the Tenant, though shy of acknowledging the utmost Advantage, confest to me, that he thought it yeilded him double the former Income. And a Gentleman of Quality of my Acquaintance, whose Improvements I went lately to view, shew'd me a Scope of Ground, which at his first coming to that wild place (four or 5 years agoe) was boggish, and which yet he had turn'd into a good dry Soyl, by onely trenching it here and there with shallow Trenches of not a Foot deep, and overflowing it (by the means of those Trenches, and conveniently plac'd Dams) as evenly as he could 5, 6, or 7 times a Year, betwixt the beginning of October, and about the middle of April with the Water of a neighbouring Spring, which was no way enrich'd by Land-floods, arising but in a very barren and uncultivated place, far from the neighbourhood of Grounds capable of enriching it; and yet this Spring drain'd away (if I may so speak) that Ancient Hydrotical Distemper of the Land, and turn'd it, as I found by Trial, into a good compact Soile, on which store of
Mowers

Mowers were (when I saw it) imploy'd in making of Hay, which this Meadow yeilded plentifully enough to be worth 20 times its former value. Nor is this the single Considerable Instance we have met with, of the Improvement that may be made of divers kinds of Land, onely by skilfully overflowing them with common waters.

But, *Pyroph.* I may hereafter have so many occasions to mention particulars relating to Agriculture, that I should presently dissmisse them in this Essay, were it not that I am by my having nam'd Husbandry to you, put in mind to imploy it as an Instance to confirm this Observation, That the more comprehensive a Trade is, the more likely it is that it will be capable of being meliorated by Natural Philosophie. For such Trades, as are of great extent, are oblig'd to deal with a considerable number of Natures Productions, and to make use of divers of her Operations, and consequently must comprehend the more particulars, wherein the Manufacture or Profession may be reform'd, and otherwise advantag'd by a knowing and dexterous Naturalist. Thus the Husbandman's Corn makes it fit for him to have a competent skill in the whole Art of Tillage, the keeping of Cattle great and small, the ordering of Dairies, of Wood, of Flax and Hemp, of Hops, of the Kitchen-garden, of an Orchard, of Bees, &c. besides that the particular Productions of some of these, as Honey, Cydar, &c. require some skill, and are capable of much Improvement; so that among so great a variety of things wherewith the Husbandman has to deal, it can scarce be otherwise than that there will be several things, wherein the Naturalist's higher and more reaching Knowledge and Experience will be serviceable to him. And whereas in the Preservation both of Cattle from Diseases, and of the Fruits of the Earth from Putrefaction, lieth one of the most beneficial and difficult parts of the Husbandmans skill, he may therein be much assisted by an expert

Naturalist, who not onely, by being able to accelerate Putrefaction in divers Bodies, may teach the Husbandman to furnish himself with great variety of Composts and Manures, to relieve and enrich his Ground with what ever peculiar sort of Salt he observes to be deficient; but also may teach him how to preserve many of his Seeds, and Flowers, and Fruits, beyond their wonted duration: as I know some persons, to whom I recommended Methods of this kind, that use to preserve Quinces, for Instance, a great part of the Year, by a strong Liquor (or Pickle) made of nothing but Water, and what (for the most part refuse stuff) may be easily obtain'd from the Quinces themselves. This way presented us Fruit at almost the Years end; and a while since I could have shewn You (and, for ought I know, can do so yet) Cherries well shap'd, and succulent enough, of above a Year old, preserv'd without Salt or Sugar, by being kept in a spirit of Wine fitted for that use, and fully impregnated before their immersion with the Tincture of the skins of other Cherries of the same kind. The vast Benefit that the *Hollanders* derive from the best way of Salting or Pickling of Herrings, and the advantageous use that is made by others of so powdering Beef, and ordering other Flesh, that twill last good to the *Indies*, and is sometimes brought uncorrupted into these parts again, may perswade us of the Benefit that may accrue to the Husbandman, by the Discovery of the wayes of keeping the Productions of the Earth from Corruption; especially if his skill be extended to weak Wines, Cidar, Perry, and other Liquors, which are wont to be made in great Quantities, and yet apt to decay at home, and unfit to be transported far abroad. And the use of Sugar to strengthen vinous Liquors, and make them durable; and, without the help of Salt or any sharp thing, to preserve great variety of Fruits, and of the Juices of Herbs, may encourage us to think, that there may be very differing wayes
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(and some of them seemingly opposite) to make many things outlast their Natural periods of Duration.

But my Trials and Observations (whether about the conserving of Fruits, Flowers, and Flesh, or of other things of this sort) belonging more properly to another Discourse (*Of the Preservation of Bodies*) I shall now mention no more of them, but passe on to tell you, that very much prejudice, which often happens to the poor Husbandman (and sometimes even to his utter ruine) by those either stubborn or contagious Diseases, (such as the Rot in Sheep, and the Glaunders in Horses,) that make havock of his Cattel, may in great measure be prevented by the instructions of a knowing Naturalist, especially if he be an expert Physitian too. For, as many Diseases, so many Cures are analogous in Men and Beasts, and the Remedies prove frequently more successful in these than in them, as well for divers other Reasons, as because the Bodies of many Brutes are more able to bear the Operation of strong Remedies; and yet the unaccustomedness of almost all of them to Physick, makes them more relievable than Men by any (not improper) Remedies. I will not now relate that I have in some Countries found Medicines that have been usefully tried against Diseases in Men, cry'd up for their efficacy against their analogous ones in Horses; nor with what difference in the Dose these may be purg'd by several of the same Catharticks, especially Aloes, that are employ'd for the Purgation of humane Bodies. I shall rather inform you, that *as* in these, Salt is (you know) reputed a great resister of Corruption, and an Enemy to Worms, (with a sort of which the Livers and neighbouring Vessels of Sheep have been observ'd to be infested;) so by the bare use of (*Spanish*) Salt, of which each Sheep, being first made to bleed a little under the Eye, was made to take down a small handfull two or three times (with some dayes of Interval,) without being suffer'd for

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some hours to drink any thing after it: by this Remedy, I say, given at the time of the Year when there is danger, that the Sheep will begin to be botcht, many Flocks have for divers Years been preserved by a rich intelligent Gentleman of my Acquaintance, that is a great Sheep-master, and has thereby (and that also lately) preserv'd his Flocks in a moist Countrey, when most of his Neighbours lost theirs. I might here mention to you, *Pyr.* the Virtues of crude Antimony, to cure the foulness of Blood, and even the Leprosy in Swine; of Quick-silver, to cure the Worms in Horses; of *Palmarinus* his famous Remedy, which he solemnly affirms to be a constant one against the Bitings of a mad Dog in Cattle, and of a more parable one for Men also, whose success I almost admir'd in a neer Relation of Yours and Mine; of the use of the Antimonial Cup for several Sickneses in Horses and Sheep, which (if I mis-remember not) was successfully tried by one to whom I recommended it; and of another Antimonial Medicine, which (though much commended to me by a *Virtuoso* that took it himself) a Gentleman of my Acquaintance resident in the Countrey, who prepares it, assures me, that he uses it with strange success to fatten his Horses, (made lean by occasion of Sicknesse,) with whom yet it works not, either as an Emetick, or a Purge. And I could here present you divers other Receipts much priz'd for their having (as well as the newly mention'd Remedies) frequently been found effectual against the same Diseases both in Humane Bodies and in Brutes, if I did not think it lesse proper to make in this place a *Veterinarian* Excursion, than to tell You, that, if You have any Curiosity for them, You may command them.

I might adde, if I had leisure, some Reasons why I despair not that in time the Husbandman may, by the Assistance of the Naturalist, be able to advance his Profession by a Therapeutical part, which may extend not onely to the Animal
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productions of the Ground, and to the Vegetable ones; but (in a large acception of the Term) to the Distempers of the Ground it self. For if the Causes of the Barrenness of Soils in general, and of their Indisposition to cherish particular Plants or Animals, were by the Philosopher's sagacity discover'd, I see not why many of those Defects may not be remov'd by rational Applications, and proper wayes of cure; as well as wee see Inconveniencies remedied in many other inanimate Bodies, without excepting the close and stubborn Metalline ones themselves.

And perhaps also, that by a way of management suggested by the knowledg of Causes, the barrenness of a Soil may be cured, or its Fertility much promoted by methods, that do nothing neer so much require Cost as Skill. Some ingenious Husbandmen have of late proclaim'd themselves much satisfied with a way of correcting two of the barrenst sorts of Land, not by rich Manures or other costly cultures, but by skilfully mixing the Sand and Clay themselves in a due proportion, according to the Use the Husbandman designs to make of it. And whereas one of the best modern Writers of Agriculture reports, as he may, for a strange thing, that he had seen seven or eight and thirty Ears of Barley that sprung from one Grain; I remember, that an Ingenious Gentleman, to satisfy some Curious persons what might be done in that kind, sow'd Corn upon a piece of Land, very neer the place of my abode, which prosper'd so strangely, that one Root that I took particular notice of, though perhaps not the fruitfullest in the field, produc'd sixty and odde Ears of Corn, and yet, which was the strangest, this wonderful Increase depended upon a Philosophical Observation; nothing extraordinary having been done, either to the Land, or so much as to the Seed; as I had opportunity to know, both by the informations of observing men, and by the confession of the Gentleman himself, who was

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pleas'd to make choice of me to intrust his Secret with, that in case he dyed before me, the publick might not loose it. Upon which account he also confided to me another Specimen of his skill. He once presented your Excellent Mother a company of several sorts of choice Apples, among which there was one sort excellently tasted, but very small; the following Year he presented her another Basket of the like Fruit, but finding no small ones among them, she took occasion to ask him, What was become of the Tree that produc'd those delicious little Apples, that made part of his former Present? to which he replied, that he had brought several of its productions among the other Fruits she was looking on, and thereupon shew'd her some that came from the same Tree, and appear'd by the peculiar Relish to be of the same sort, though exceedingly differing in Bulk, that neither your Mother, nor I, had any suspicion that the same Tree bore them. Upon which occasion he readily gratified my Curiosity by acquainting me with his way, which depended almost onely upon a Physical Observation; all that he added being not any rich Compost, but some despis'd Leaves of a very cheap and common Vegetable. But Husbandry is too large a subject for me to prosecute in this place, and therefore I shall here dismiss it.

THE III. SECTION.

THe next thing I shall observe to You, *Pyroph.* is, that 'tis not onely to the Trades that minister to the necessities of Mankind, but to those also that serve for Man's accommodation or delight, that Experimental Philosophie may bring Improvements; for these Arts also do for the most part consist in the knowledg and application of some of Natures Productions and courses, whose being referr'd to the accommodation or delight of Men, rather than to any other

other purpose, does produce nothing that is truly Physical in the things so referr'd, which thereby acquire onely such a kind of respect to Man, as that which the Metaphysicians call an *Extrinfecal Denomination*; and we see that the same things, without varying their Nature, are serviceable to men in very differing capacities: as Wine serves one that is dry to quench his Thirst, serves a fainting person to revive his Spirits, and the Drunkard to inebriate him; the same Spirit of Wine that serves the Physician to make Tinctures and Extracts for the recovery of Health, may serve the Ladies to dissolve Benjamin into a tincted Liquor, that diluted with fair Water, may be us'd as a Cosmetick, which I have received many thanks for; and the same Spirit skilfully employed upon Ingredients to be nam'd to you ere long, is of excellent use for making of divers fine Varnishes made with rectify'd Spirit of Wine; nay the newly mention'd Solution of Benjamin may it self be applied to all those differing uses; for of it self it is a pretty and odoriferous Varnish, and I have us'd it (though not often, for want of opportunity) with very good success against a sort of Tetters, which I caus'd frequently to be bath'd with it. What happy applications Knowledge and Skill may make even of unpromising things, to the furnishing men with Delights, is me thinks very evident in Musical Instruments, (as Lutes, Viols, &c.) For who would think (if Experience did not assure us of it) that with a few pieces of Wood join'd together, and the Guts of Cats or Lambs wreath'd or twisted into Strings, the skilful Musitian, by the help of Mathematicks and Exercise, should be able to charm the Ear with the greatest, as well as most innocent, Delights, the Sense belonging to the Organ is capable of, and which sometimes does not onely please, but ravish the transported Hearers. But though, *Pyrophilus*, as I was lately saying, Physicks may not onely be very improving to those Arts and Professions that serve to provide man with

with the Necessaries or Accommodations of Life, but also to those that serve chiefly to furnish him with Pleasures and Delights; as might be instanc'd in Experiments of Colouring, Perfuming, making Sweet-meats of all Sorts, embellishing the Face with Cosmeticks, and divers others of the like voluptuous nature: and though I may elsewhere have occasion, when I come to treat of Colours, Odors, Tasts, and other Qualities, to acquaint you with some Receipts and Experiments of this kind, yet now I do not onely want leisure to mention them, but am desirous that Natural Philosophy should engage You to Court her, rather by Her gratifying and enamouring your Reason, than by Her bribing and inveigling your Senses.

THE IV. SECTION.

THough what has been represented about the Usefulness of Experimental Philosophy to Trades, does chiefly belong to those, wherein Natures Productions are imployed to Humane Uses, by those Operations wherein Nature her Self, rather than the Artificer, seems to have the chief hand, as the Trades of Brewing, Baking, Gardening, Tanning, &c. yet I would not exclude those very Trades wherein the Artificer seems to be the main Agent, and in whose ultimate Productions the chief thing, that is wont to be consider'd, is the adventitious Shape or Form, which the Artificer, as an intelligent and voluntary Agent, does, by the help of his Tools, give the Matter he works on, as in the Trades of the Smith, the Mason, the Cutler (when distinct from that of the Sword-maker,) the Watch-maker, and other Handicrafts. For though these consist rather in the Manual dexterity of Men, than the skilful ordering of the Productions of Nature, by their material Operations upon one another, yet to many, if not all, even of these, the Naturalist may some way or other be a Benefactor.

For

For there are divers of these Manual Trades, that, especially as they are exercis'd in Cities and greater Towns, consist of several parts, and have need of several other Trades to prepare Materials for them, and dispose them to receive the last Form which the Artificer is to give them, to fit them for Sale. And we may in many cases observe, that though this Artificer, that gives the Matter this last Form, does it chiefly with his Hands and his Tools, yet those other Tradesmen, to whom he is beholdling for his Materials, do some or other of them, to prepare and qualify them for his Use, need some Observations of the conditions of the Body they deal with, or must imploy some Physical Operations, wherein they may be much assisted by the knowing Naturalist, who may also teach the manual Operator himself how to make choice of his Materials, and examine the goodnesse of those that subordinate Workmen shall bring him. Thus though Stone-cutting be a Trade, that seems to consist almost wholly in giving, with proper Tools, to Marble, Free-stone, and other Materials, the Shape which the Artificer designs, yet, if I had leisure, I could easily shew You, that even in this Trade there are many particulars, wherein Experimental Philosophie might be helpful to the Artificer. For wayes, hitherto unus'd, may be found out (as I have partly tried) to examine the nature and goodnesse of the Marble, Alabaster, and other stones which the Mechanicks deal with. A competent knowledge of the Sap that is to be found in Stones imploy'd for Building, is of so much importance, that the experienc'd Mr Workmen have confest to me, That the same sort of Stone, and taken out of the same Quarry, if digg'd at one Season, will moulder away in a very few Winters; whereas digg'd at another Season, it will brave the Weather for very many Years, not to say, Ages: (but of my Observations of this kind more elsewhere.) The Cements also, and Stoppings (as

(as they call them) which are of good use in this Trade, may be easily better'd by the Naturalist that is vers'd in such Mixtures. And I remember I had occasion to teach a fine Cement for the rejoyning of the broken Limbs of Statues to their Bodies, to an inquisitive Artificer, who by such like helps did in other cases so well counterfeit Marble with a Cement, that even where there was occasion to fill up great Cavities with it, the work would passe for entire; the Additaments being not distinguish'd from the Natural Marble. Want of Curiosity also keeps our Stone-cutters here in *England* unacquainted with the ways of working upon Porphiry, which they will not undertake either to polish or to cut. Nor is *England* the onely Countrey where the Art of working upon Porphiry (which appears to have been in great use amongst the *Romans*) is unknown, though at *Rome* there are some few that do with great Gain exercise it. And though I know not precisely what tis they imploy, yet I presume it may be Powder of Emery: for with That and Water, and Steel-saws, I have here in *England* caused a Porphire stone to be cut. And the mention of Porphire puts me in mind of telling You, that by an Art I have, white Marble may be so stain'd, and that durably, with Spots great or small, and red or brown, as it pleaseth the Artificer, as I may hereafter have occasion more fully to relate. 'Twould be too long to discourse to you here of Artificial Marble, and divers other things that Stone-cutters affirm to belong to their Trade, wherein you will scarce doubt, but that it may be capable of improvement. Wherefore I shall onely adde, that whereas this Profession does much require very good Steel-tools, and they must have these from Smiths, and others that deal in Iron, if these Mens Trade were better'd by the Naturalist, they might be able to afford the Stone-cutter the better temper'd Tools: and that even the Smiths Craft, though it seems to be meerly a Manual Art, is yet

capable of much melioration by the knowledge of Nature, were not difficult to manifest, if twere proper here to insist on the Proofs of it; yet thus much I shall here take notice of to confirm this IV. Observation, That not onely the Philosopher may, as a Mineralist and a Mechanician, improve the wayes of making Iron and Steel, before they come to the Smiths hand, but likewise may devise better Expedients, than are among us in use, for the ordering of Iron and Steel, when it comes to be formed into Weapons and Tools. The Sword-blades, and other Arms, that are made at *Damasco*, are very famous every where, and (as far as some Trials have inform'd us) justly for their excellency in cutting even Iron. And yet it seems to be onely the skill of the Artificers in ordering it, that gives the Swords and other Instruments made at *Damasco*, so great a preheminance above others. For though the goodnesse of them have been presum'd to proceed from that of the Iron-mines, and Steel, peculiar to the Region of that City; yet the judicious *Bellonius*, having made particular Enquiry at his being there, informs us otherwise, and tels us, that Iron and Steel, being brought thither from other parts, (the Countrey having no Mines of it) receives there from the skill of the Workmen its Temper and Perfection. And I see not why I may not reasonably suppose, that in the tempering of Steel, tis not onely the goodnesse of the Metal, and the determinate degree of Heat, though these be the onely things Artificers are wont to look after, that give the best Temper; but that much may depend upon the Nature of the Liquors, or other Bodies, wherein the hot Steel is plung'd, and upon other wayes of ordering it, if those be skilfully chosen and imployed. I have had a Graver so well temper'd, (but by whom I know not) that all the known wayes us'd by me and others, (who wondered, as well as I, at the unsuccessfulness of our Endeavours,) could not deprive it of its Temper, as they would

P. Bellonius observat. lib. 2. cap. 93.

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have

have done any Gravers that we make here ; and twas afterwards affirm'd to me, that it was made of Steel temper'd at *Damasco*.

I may elsewhere tell You, *Pyrophilus*, both of a way I have tried, of hardening Gravers, without quenching them in any Liquor or Tallow, or any other Unctuous Body; and that having perswaded an Ingenious Artificer to try an unpractic'd way of tempering Gravers, he soon after brought me one to see the goodnesse of it, which, by being plung'd in a certain cheap Mixture, (wherewith I may hereafter acquaint You) had been harden'd and temper'd at once: which though most Artificers would think scarce possible, yet upon the Authority of Trial, I shall venture to deliver what some may think as strange, namely, That though Ignition and Extinction in cold Water, be the common and known way to harden Steel (Gravers,) yet by that way, onely observing precisely a Nick of Time, Steel may be made strangely Soft. But of this more elsewhere. I shall now adde, That having enquir'd of one of the Curiouslest, and most observing Makers of Steel-Tools, whether he did not find a difference in the imploying of Pump-water, or River-water in giving them their Temper, he satisfied me that he did so; and observ'd the former to be fitter for some sorts of Tools, and the later for others. There may be divers other Particulars, wherein Iron and Steel may be improv'd by the Naturalist. The first may be this: that the Metal berender'd so soft, as to be, by the help of strong Moulds, put into Shapes. This an Eminent and credible Artificer assur'd me, he had often seen his Master do to Iron, with considerable profit. Or else it may be made fusible like another Metal, as I remember I have (sometimes with a certain Flux-powder, which I compos'd, if I much forget not, of Tartar, Sulphur, and Arsenick) made it run, even with a Charcoal fire, into a Masse exceeding hard, and very polishable.

able. A third way may be this: That it be so ordered, as to be preserv'd very long from Rust, which an Ancient *Virtuoso*, who had purchas'd the Secret of a rare Artist, for a great Prince, and us'd to shew his Friends Steel so prepar'd, assur'd me was done chiefly by tempering it in Water well impregnated with the Bark of a certain Tree. In a word, there may be divers other wayes whereby Iron or Steel themselves, or their Trades that imploy them, may be meliorated; and to adde, that on this occasion there are many and very differing accounts, upon which a Trade or Profession may be benefitted by the Experimental Philosopher: for he may *either* find out variety of Materials wherewith to perform the things desired by the Tradesman, *or* he may render those Materials that are already in use, better condition'd; *or* he may discover and reform the unheeded Errors and Mistakes to be met with in the Trade; *or* he may devise more easie and compendious wayes of producing the Effect that is required; *or* he may improve some of the auxiliary Trades, of which the Trade spoken of has need or use; *or* he may instruct the Artificer to choose, and examine, and preserve his Materials and Tools, better than is usual, *or* can make the ultimate Productions of his Trade sooner, or cheaper, or easier, or better condition'd, or applicable to more Uses, or more durable, than they are commonly made. Nor are these all the particulars that might here be enumerated to the same purpose, if this IVth Consideration had not detain'd us too long already.

THE V. SECTION.

THE Naturalist may increase the Power and Goods of Mankind upon the account of Trades, not onely by meliorating those that are already found out, but by introducing new ones, partly such as are in an absolute sense *newly*

ly invented, and partly such as are *unknown* in those places, into which he brings them into request. For twere injurious both to Nature and to Man, to imagine that the Riches of the one, and the Industry of the other are so exhausted, but that they may be brought to afford new kinds of Employments to the hands of Tradesmen, if Philosophical Heads were studiously imployed to make Discoveries of them. And here I consider, that in many cases a Trade differs from an Experiment, not so much in the Nature of the thing, as in its having had the luck to be applied to Humane Uses, or by a Company of Artificers made their Business, in order to their Profit; which are things Extrinsecal, and Accidental to the Experiment it self. To illustrate this by an Example, the fishing Explosion made by a mixture of Nitre, Brimstone, and Charcoal, whilst it past not further than the Laboratory of the Monk, to whom the Invention is imputed, was but an Experiment; but when once the great (though unhappy) Use that might be made of it, was taken notice of, and Mechanical people resolv'd to make it their Profession and business to make Improvements and Applications of it; this single Experiment gave Birth to more than one Trade: As namely, those of Powder-makers, Founders of Ordinance, Gunners (both for Artillery and Mortar-pieces,) Gun-smiths; under which name are compriz'd several sorts of Artificers, as the makers of Muskets, small Pistols, common Barrels, screw'd Barrels, and other varieties not here to be insisted on.

The Discovery of the Magnetical Needles property to respect the Poles, has given occasion to the Art of making Sea-Compasses, as they call them, which in *London* is grown to be a particular and distinct Trade. And divers other Examples may be given to the same purpose, especially where Mechanical Tools and Contrivances cooperate with the Discovery of Natures Production. So that oftentimes a

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very few Mathematical Speculations, or as few Physical Observations, being promoted by the contrivance of Instruments and the practice of Handi-crafts men, are turn'd into Trades; as we see that a few Dioptrical Theories lighting into Mechanical hands, have introduc'd into the World the Manufactures of Spectacle-makers, and of the makers of those excellent Engines, Telescopes and Microscopes.

The observing, that though Quick-silver will Amalgame with Gold (and thereby seem to be destroyed, (which made *Pliny* think it an Enemy to Metals,) yet it may be separated from the Gold again without diminution of that noble Metal) has brought forth the Trade of Guilders, whose Art consists chiefly in mixing, by the help of a competent heat, good Gold with five, six, or seven times its weight of Quick-silver, till the mixture come of such a consistence that they may spread it as they please upon the Silver or Copper to be gilt. For having by this means overlaid it evenly with Gold, they can easily with fire force away the Mercury; and with a liquor impregnated with Nitre, Verdigrease, Sal Armoniack, and other Saline Bodies, which they call a Colourish, restore its lustre to the remaining Gold, which they after make bright by polishing.

The almost obvious and trivial Observation made by some sagacious person (whoever it was) that a Spring was a Physical continual and durable Power or Force, and the Corollarie he thence deduc'd, *that this Force, skilfully applied, might be equivalent to the Weights that were thought necessary to move the wheels of Clocks:* these Reflections, I say, join'd with a Mechanical Contrivance, produc'd those useful little Engines, Watches, that now afford a plentiful Livelihood to so many dexterous Artificers; which though Custome has made familiar to us, yet were unknown to the Ancients, and highly priz'd and admir'd in *China* it self, when first (in the last Century) brought thither. The Discovery of the
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virtue of *Aqua fortis* to dissolve Silver and Copper without working upon Gold, added to the Observation, That Lead melted with either of the two noble Metals, and then forc'd from them by Fire, will carry away with it any of the baser Metals that may have been mixt with them; (these two particulars, I say) have begot in later Ages the Art of the Refiners we now have.

Mens having observ'd the Operations of some Lixiviums, Claies, and a few other familiar things upon the Juice of the Sugar-Cane, has not onely occasion'd the adding of the Culture of those Reeds to the other parts of Husbandry left us by the Ancients; but has produc'd the several Trades of Sugar-boilers, or makers of Sugar, Refiners of Sugar, and Confectioners: not to mention the great addition the concreted Juice of the Sugar-Cane brings to the Apothecaries Profession, upon the score of Syrups, Conserves, Electuaries, and other Saccharine Medicines. Nay, a very slight manual Contrivance or Operation, if it light fortunately, may supply men with a Trade, as in the Art of Printing. To which I shall onely adde, that in *China*, and some other Eastern parts, the lucky Trial that some made to bore very small Holes through *Porcellane* or *China* Cups, and employ very slender Wire in stead of Thread or Silk, has given being to the vulgar Trade of those people that go up and down in those Countries, as Tinkers do with us, getting their Livelihood by sewing together the pieces of crackt or broken *Porcellane* Vessels: as I have been inform'd by more than one credible Person that liv'd in the East, and had Experience of the use of Cups so mended, though fill'd with Liquors as hot, as they are wont in the East to drink their Coffee and Tée.

The mention freshly made of *China*, brings into my mind, That whereas the knowledg of some Gums and Liquors in that Countrey, afforded them those useful, as well as most beautiful,

beautiful, Varnishes, which we call by the name of the Kingdom that supplies us with them; and which do both there, & in *Japan*, employ multitudes of Tradesmen; I am credibly inform'd, that the Art of making the like Varnish'd Wares, is now begun to be a Trade at *Paris*, and I doubt not but it will ere long be so in *London* too. For though some Accounts, that were given me by *Virtuosi* of that Varnish, were such, that the Trials of them did very ill answer Expectations, yet having read in *Linschoten's* Voiages, that in *China* and *Japan* they make this excellent Varnish of Gum *Lacca*, I found by some Trials, that I was able to imitate one of the best sorts of it, by dissolving the Gum in high rectified Spirit of Wine, and then giving it a Colour, and laying it on in such a manner as I may have ere long a fitter occasion to inform You.

See the App. to the V. Essay.

And without much impropriety, I might alleadg the Art of cultivating and gathering Sugar-Canes, and of ordering their Juice, as a recent Instance of the transplanting of Arts and Manufactures. For, as I am inform'd by very credible Relations, there are not yet very many years efflux'd, since, in our memory, a Forreigner accidentally bringing some Sugar-Canes, as Rarities, from *Brasil* into *Europe*, and happening to touch at the *Barbadoes*, an English Planter that was Curious, obtain'd from him a few of them, together with some Hints of the way of cultivating and using them. Which, by the Curiosity and Industry of the English Colony there, were in a short time so well improv'd, that that small Island became, and is still, the chief Storehouse that furnishes, not onely *England*, but *Europe* with Sugars. And this Instance I the rather mention, because it is also a very notable one, to shew, how many Hands, the Introduction of one Physico-Mechanical Art may set on work; since I have had particular opportunity to learn by Enquiry, that the *Negroes*, or, as they call them, *Blacks*, living

ing as Slaves upon that spot of Ground, and employ'd almost totally about the planting of Sugar-Canes and making of Sugar, amount at least to between five and twenty and thirty thousand persons. And that you may see how Lucriferous in that place this so recent Art of making Sugar is, not onely to private men, but to the publick; I shall adde, that by divers intelligent and sober persons interested in the *Barbadoes* (and partly by other ways) I have been inform'd, That there is, one Year with another, from that little Island, which is reckon'd to be short of thirty Miles in length, (and so I found it, by measuring it on one of the fairest and recentest Maps,) shipt off for *England* (especially,) ten thousand Tun of Sugar, each Tun being estimated at two thousand Pound weight, which amounts to twenty Millions of Pounds of that Commodity; which though it may seem scarce credible, yet one of the Antient Magistrates of that Island lately assur'd me, that some Years it affords a much greater quantity.

I shall not fortifie what I have hitherto discours'd with Particulars, that will elsewhere more properly fall in; it being sufficient for my present purpose, that the Instances already mention'd may render it probable, *That the Experimental Philosopher may not onely Improve Trades, but Multiply them*, till I have occasion in the Last Essay of this Book, to make it out more fully. Nor do I despair, that among other ways whereby Trades will be increas'd, one may be the retrieving some of those that were anciently practic'd, and since lost, of which we have a Catalogue in the Learned *Pancirollus*. For as tis the skilful Diver's work, not onely to gather Pearls and Coral that grew at the bottom of the Sea, and still lay conceal'd there; but also to recover shipwreck'd Goods, that lay buried in the Seas that swallowed them up: so tis the work of the Experimental Philosopher, not onely to dive into the deep Recesses of Nature, and
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thence fetch up her hidden Riches; but to recover to the use of Man those lost Inventions, that have been swallowed up by the Injuries of Time, and lain buried in Oblivion. This I do not say altogether groundlessly, though for some Reasons I here decline mentioning the things that induc'd me to say it.

THE VI. SECTION.

TO what has been hitherto said, I shall venture to adde, not onely that the sagacious Philosopher may better most of the Trades that are already in use, and adde to the number of Mechanical Employments; but that I am apt to think it might without much *Hyperbole* be affirm'd, that there is not any one Profession or Condition of Men (perhaps scarce any single Person of Mankind) that may not be some way or other advantag'd or accommodated, if all the Truths discoverable by Natural Philosophie, and the Applications that might be made of them, were known to the Persons concern'd in them. So that besides those Discoveries that are compil'd or form'd into Trades, there are, and may be, found, a multitude of loose particulars, whereby the Naturalist may much gratifie and assist men, according to the exigency of particular occasions. The nature of the thing will scarce permit me to illustrate so unlikely an Assertion, without employing instances in themselves trifling, if not despicable, of which I will therefore give you but a few, because if they were not pertinent to my present purpose, they would be fitter to divert, than inform, You.

I had, not long since, the honour to be known to a very great Court-Lady, who was much troubled, that having frequent occasion to write Letters, she could scarce handle a Pen without blacking her Fingers with Ink; I smilingly undertook to make her write without Ink, which I my self was formerly wont to doe, by first preparing my Paper with

a Powder made of Copperas, slightly calcin'd upon a Fire-shovel till it grow friable, and Galls, and Gum-Arabick finely pulveriz'd, and exquisitely incorporated with the Vitriol in a certain proportion; which though a few Trials will better teach than Rules, (because according to the Goodness and Calcination of the Vitriol, the proportion of the other Ingredients must sometimes be varied,) yet to assist you in your first Guessees, I shall tell You, that (for the most part) I used my self 3 parts of calcin'd Vitriol, 2 parts of Galls, and 1 part of Gum-Arabick, and mixt them not before I was ready to imploy them, for this Powder being with a Hares foot, or any other convenient thing, carefully rubb'd into the Paper, and the looser Dust struck off, doth without discolouring it, so fill its Pores with an Inky mixture, that as soon as it is written upon with a clean Pen, dipt in water, Beer, or such other Liquors, the Aqueous part of the Liquor dissolving the vitriolate Salt, and the adhering particles of the Galls, makes a legible Blacknesse immediately discover it self on the Paper. This mention of Writing brings into my mind, that several times having had occasion to make a Word or two, that was but lately written, look as if it had been written long before, I perform'd it, by lightly moistening the Words I would have to look old, with Oyl of Tartar *per deliquium* allay'd with more or lesse fair Water, according as I desir'd the Ink should appear lesse or more decayed: which Experiments may be often useful in Manuscripts, to keep the recent interlineations, or other Additions, from betraying themselves by their freshness not to have been written at the same time with the rest of the Manuscript.

And the Design I had in making use of the lately mentioned Powder of Galls and Copperas, puts me in mind of another way of writing without Ink, (and too without danger of blacking ones Fingers or Linnen,) which I remember

I have practis'd sometimes with one Powder, and sometimes with another. For considering that common Silver being rubb'd upon Bodies, whose Surfaces are a little rough, and even upon colour'd Cloath the Metal would leave a Blackness on it, 'twas easie to conclude, That if the surface of the white Paper were asperated by a multitude of irregular Grains of a Powder as white as it, would retain a Blackness wherever a blunt Silver Bodkin should be drawn over the grating Particles: and accordingly I found, that either exquisitely calcin'd Harts.horn, or clean Tobacco-pipes, or (which is better than that) Mutton-bones (taken between the Knuckles, and) burnt to a perfect Whiteness, being finely powder'd and sear'd, and well rubb'd upon Paper, would make it fit to be written upon with the point of a Silver Table-book pin, or Bodkin of Silver (which Metal is not absolutely necessary in this case,) as well as that which is called Mathematical Paper, (if the being prepar'd with one, or other of these Powders do not make it the same.)

And now I am upon the mention of such Preparations of Paper, I remember, that I was once in a place where I could get no white Leaves, to supply a fine Table-book that I had much use for; nor could I hear of any Tradesman in the whole Countrey, that knew the way of making so much as ordinary Table-books: wherefore I be-thought my self of trying to make something by way of *succedaneum*, which succeeded at the first attempt. And though there may be better wayes to make white Table-books, yet perhaps you will find none more simple and easie; the two onely Ingredients we had in it, being to be had at every Apothecaries Shop. I onely take Cerufs, rubb'd to very fine Powder, (which is done in a trice) and temper it up with fair Water glutted with clear Gum-Arabick. With this mixture (being brought to the consistence of a somewhat thick Salve) I rub over the Paper I prepare, putting on more or

lesse according as I would have it last, and having suffer'd it to dry (which it will quickly do) it may, if there be occasion; be presently us'd with the point of a Silver-pin, which will make the Letters appear very conspicuous upon a Mixture, that does not at all impair the Whitenesse of the Paper, and what was thus written I could, with Spittle or Water, blot out three or four times successively without spoiling the Paper. Which questionlesse had been much better prepared, if divers Coaches of the mixture had been laid on and suffered each to dry, and if afterwards the Paper had been smoothed by being scrap'd with a Knife, and polish'd.

A very ingenious Artificer, who had contriv'd an Instrument useful to others, and profitable to himself, whereof an absolutely necessary part was a Glass fill'd with fair Water, and exactly stop'd, complain'd to me, that though his Instrument did exceeding well in all but Frosty weather, yet then it was apt to be spoil'd by the freezing of the included Liquor, which too often broke the Glass. Whereupon I taught him to remedy it, by substituting in stead of Water good spirit of Wine, which has not in our Climate been observ'd to freeze, or rather (because in his bigger Glasses that Liquor would be chargeable) either Sea-water strengthned with a little Salt, or else common Spring-water with a twentieth, or at most a tenth part part of Salt dissolv'd in it. For though this Brine look (if well made) as clear as common Water, yet I have not observ'd, that the sharpest of our English Winters would make it freeze.

To a Person of Quality, that was very Curious of the way of writing secretly, I undertook to teach an easie way (which after I knew it, I found also in an old printed Book) of sending a written Message, without putting it into the power of the Bearer to betray it; which I could easily have perform'd my self, if the message were to be deliver'd in a short time, and not too far off, by writing on his Back, or other convenient

nient part of his Body, with a clean Pen dipt in my own Urine, (there being some Urines with which I have found, to my wonder, that the Experiment would not succeed.) For if he that receives the Message rubs but a little of the black substance remaining of Paper after it is burnt, those Sable parts adhering to those other of the Liquor, that lurk yet in the pores of the Skin (whence if the Messenger went fast, and very far, the Sweat would probably dislodge them) do denigrate all that was written, and make it legible enough, sometimes as I have tried after many hours.

I remember too, that intending one Summer to make some abode at a house I had in the Countrey, I sent for from London, among other things, a quantity of Damask Table-Linnen, with which he that sent it me, inconsiderately packt up a great pot of a certain Confection, which for some purposes I had caus'd to be made of the Pulp of Sloes, which, by agitation of the Horse it was carried on, being brought to ferment, and run out of the broken Pot, stain'd all the new Damask from the top to the bottom. At which an old Domestick of mine (whom you remember very well) seeming much troubled because he had sent for it, to convince him that Experimental Philosophy was not altogether useless, I steeped the stain'd Linnen, for some convenient hours, in new Milk, and afterwards causing it to be thoroughly and diligently wash'd in the like Liquor, the Damask came forth unstain'd, and almost as white as It. What Urine, if duely (and long enough) employed, may do to take Stains (even of Ink) out of Linnen, is but to be hinted in this place; where I might adde, that with *strong* spirit of Salt, where-with I moisten'd, as often as was needful, the spotted places (first wetted with fair Water,) I have out of new Linnen taken spots of Ink (especially fresh ones) of very differing sizes, without leaving (after the Linnen was well wash'd out in fair Water) any of those yellow Stains which many call *Iron-Moles*.
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Some Ingenious Persons, that deal much in Lixiviums and Brines, complaining the other day, that besides that they could not sometimes easily come at an Egg, to try, by its sinking or floating, the strength of the Saline Liquors they would examine, there needed a good quantity of the Liquor to make such a Trial in; I allow'd their complaint to be just, and the rather, because I observe, for nicer Estimates of the strength of Liquors, the Trial by Eggs is uncertain enough, in regard that even the same Egg will, as I have found, by being kept grow lighter, whence stale Eggs have usually a great Cavity (that seems fill'd onely with Air) at the bigger end: and I told them, to omit the more Artificial, but more difficult, wayes of examining such Liquors, I sometimes us'd a way, whereby I could try the strength of the Lixiviums made with Chymical Salts, though I had not above a Thimbleful of the Liquor, and this with a Body that will not easily waft like an Egg, (and therefore may be kept.) For I substituted, in stead of the Egg, a small piece of Amber, about the bignesse of a Pea, which in a very strong Solution of Lixivate Salt, will, as I let them see, swim on the top, but sink in a weak one. And as you may take a piece of Amber lesse or bigger than a Pea, as best fits your occasions, and need not be at all scrupulous about the figure, (provided the Amber be once well duckt in the Liquor;) so it is some convenience that two pieces of Amber, whereof the one is far more reddish, and the other paler, will be, as far as I have tryed, of somewhat differing Specifick Gravities, so that the one will flote in some Liquors, where in the other will sink.

I remember I was once in a Countrey, where I had a great mind to try some things with Dantzick Vitriol, or some other blew Copperas, but by reason of the Wars could not possibly procure any, though there were in that Countrey a place, where Green Vitriol was made by the help of Iron;
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wherefore getting some of that Liquor which the Rain had wash'd from the Copperas stones, I did, by putting into it a convenient quantity of Copper reduc'd into small parts, make the newly mentioned Liquor serve for a Menstruum to work upon the Metal, and by exhaling the Solution to a dew consistence, I obtain'd the Blew Venereal Vitriol I desired. And the like, I doubt not, may be done with such of those common Green Vitriols made of Iron, wherein the Saline part is not too much satiated with the Martial.

An ingenious and well known Person, that is a great Dealer in Cider, coming to visit me, and expressing a great desire to be able to make some that would be stronger, and thereby likelier to keep longer than the ordinary way, I *ex tempore* directed him to an unusual course, for which he afterwards came to give me solemn Thanks. The way was to take the strained Juice of Apples, and in 10 or 12 Gallons thereof to steep for 24 hours (more or lesse) about two Bushels of the same kind of Apples grossly bruised, the Apples being lightly express'd, the Infusion was (with fresh) repeated once more, (care being to be taken, that the Infusion be not made too strong and thick, which may hinder the seasonable Clarification of the Liquor.)

It was not perhaps difficult to mend this Prescription, but I give you the Account of it, as I receiv'd it from him, because he assur'd me that none of his many Trials had furnished him with Cyder so well Bodied, and so much applauded. The Cautions that belong to this Practice, and the various Applications that may be made of this way of making Vinous Liquors of Fruits, without Additions (so much as of Water,) by Infusion, and the varyings of the Experiment according to particular Cases, I must not here stay to mention.

It was not long since, that accidentally Rummaging in a dark place, where I had not of a long time been, and where un-

unknown to me some Chymical Glasses, negligently stopp'd, and not written on, had been put; one of them falling down made two or three great Stains in the conspicuous part of a new Suit I had then on; and would have oblig'd me to leave it off, but that judging by the nature of the Stain that was made with some acid Spirit, I tryed, by smelling to them, whether among the other Bottles one or other had not some Urinous or otherlike Spirit; and lighting on a Liquor, which though I knew not what it was, I guess'd by the Stink to abound with volatile Salt. I bath'd the stain'd parts well with it, and in a trice restor'd them to their former Colour. And by a like way I have presently remedied the Discolorations made by some sharper and fretting Liquors, of dy'd Garments of other sorts and Materials, which those Blemishes would else have rendred altogether unfit for wearing.

Another time discoursing with a States-man of the ways whereby well-meaning Persons may be injur'd and defam'd, I undertook, that out of a Parchment-writing with his hand annex't, I would take out all that was written above his Name, without spoiling or disfiguring the Parchment, on which I would afterward write what I pleas'd, and whereby I might make People believe that he had acknowledg'd under his Hand such things, as never came into his Thoughts. And to satisfy him of the possibility of this, I did in a few Minuts take off from the Parchment all that was written on it, without defacing the Parchment. Some attempt to free Paper from what is written-upon it with *Aqua fortis*, but that by discolouring the Paper, makes men apt to suspect some intended Deceit. And for the true way of performing such an Effect, and divers others of the like nature, which I have sometimes for Curiosity prosperously experimented, I think it much fitter to be conceal'd than communicated, because if such Secrets should fall into the hands of persons inclin'd to mis-apply them, they might very much disturb

Humane

Humane Society. And therefore it is better men should want the light afforded them by such Experiments, than be brought into the danger of such Mischiefs, as they may be made to suffer by the mis-employment of such Discoveries.

I remember, that not long since, a *Virtuoso* happening to have made a Solution of Gold, wherewith he thought to make *Aurum fulminans*, thought he had cause to suspect that it had been enbas'd with Copper, and therefore would not be so fit for his work; whereupon I consider'd with my self, that a good Urinous Spirit being employ'd in stead of the usual Menstruum (Oyl of Tartar,) as it would precipitate Gold out of *Aqua Regis*, so it would readily dissolve Copper, I conjectured, that by the affusion of such a Liquor I might both discover whether the Solution (whose colour did not at all accuse it) contain'd any Copper, and if it did free the Gold in great part from the baser Metal: and indeed I found, that after the Urinous Spirit had precipitated the Gold into a fine *Calx*, the supernatant Liquor was highly ting'd with Blew, that betray'd the Alloy of Copper, that did not before appear.

I hope you think, *Pyrophilus*, that tis because these Instances are more pertinent to my Design, than many others (that might have been substituted) in themselves more valuable, that I have mention'd such inconsiderable ones; and I shall not repent the naming of such Instances, if they have let you see, that even mean Experiments are not to be despised, but that the meanest may be sometimes not onely useful, but more proper to convince Strangers to Natural Philosophie of the manifold Uses of it, than Experiments of a higher and abstruser nature. For as in a Shipwrack, it may more advantage the distressed Pilot to know the supporting nature of a Bladder fill'd with Wind, though otherwise but a despicable and airy thing, than to know the abstrusest

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properties of the Magnetick Needle; so in some cases the more obvious and slight Experiments may be much more welcome and serviceable to us, than others at other times much more considerable. So true is that of the Wise man, *That every thing is beautiful in its Season.*

For my part, I am very apt to hope, that Natural Philosophy will prove *more* and *more* serviceable, both to single Persons in their particular Occasions, and to Trades themselves in General: as by other wayes, so especially by making a further search into, and thereby detecting new Qualities, or discovering unheeded Uses, of the Productions of Nature, and of Art that are already known.

I will not here take notice of what may be further hoped for in the detection of the Medical Virtues of things, because I treat of that Subject in a more proper place: and as for the Mechanical Uses (if I may so call them) and Applications of the works and Laws of Nature, *though* he that gazes upon the seemingly great variety of Productions to be met with among Tradesmen, and in the Shops of Artificers, may be tempted to think, that Art has curiously pryed into, and employed, almost all the Materials that Nature could afford it; *yet* he that shall more narrowly and severely consider them, may easily discern, that Tradesmen have really dealt with but very few of Natures Productions, in comparison of those they have left unemployed; and that for the most part they have, in the things they daily converse with, scarce made use of any other, than the more obvious Qualities of them; besides some few more lurking Properties, which either Chance, or a lucky Sagacity, rather than Inquisitiveness or Skill, discover'd to them. And indeed this great variety of Productions we have mentioned, proceeds more from a Manual dexterity of Diversifying a small number of known things into differing shapes, than, *either* from the Plenty of Natural or Artificial Productions they work upon,

on; or any diligent or accurate Search made into the Qualities of those Productions. But because to a Considering man, it cannot but be Obvious enough, that the Uses of the things they deal in, and much more those of other Concretes, which they are not engag'd to observe, have not been hitherto sufficiently enquir'd into, I shall content my self to add, That if men were but sensible enough of their own Interest, and in order thereunto would keep their Eyes heedfully open, partly upon the Properties of things, and partly upon the Applications that may be made of those Properties to this or that use in humane life, they might not only discover new Qualities in things, (some of which might occasion new Trades,) but make such Uses of them, as the Discoverers themselves would never before hand have suspected or imagin'd: whereof I may, God permitting, give you elsewhere divers Instances.

THE VII. SECTION.

After the foregoing general Considerations (about the Usefulness of Natural Philosophy to the Empire of Man over things Corporeal,) which I thought fit to take notice of in this *I. Essay*, it remains, *Pyroph.* that I also add a word or two about *those* that are to follow.

And first you must not expect that I should Methodically enumerate, and particularly discourse to you of all the Grounds and Motives I may have of looking for great Advantages to accrue to Mankind, by Mens future progresses in the discovery of Nature. To entertain You with Considerations, which perchance you would judg but Speculative and remote Concepts, would exceed my leisure, and perhaps be unwelcome to You: and therefore I choose to confine my self to the insisting on those Grounds of Expectation, which I can render probable by Examples and Instances

stances of what is already actually attain'd to, or at least very likely (in no long time) to be so. And this Advertisement I thought necessary to premise, partly indeed that you may not think that I have overlook'd all the particulars pertinent to my Subject that I shall leave unmention'd, but much more that you might not suspect, that there are no other Inducements to hope much from Experimental Philosophie, than those you will find treated of in the following Essayes. And this one thing in particular I dare not forbear to give you notice of, that for the freshly intimated reason, you will there find omitted one of the principal Grounds of hoping great matters from improv'd Physiologie, namely, that by the sagacity and freedom of the Lord *Verulam*, and other Lights of this Age, considering men are pretty well enabled both to make Discoveries, and discern a possibility of removing all the Impediments and other causes of Barrenness that have hitherto kept Physicks from being considerably useful to Mankind; such as *many* false and fruitlesse Doctrines of the Schools; *the* prejudices by which men have been hitherto impos'd on about Substantial Forms, the unpassable bounds of Nature, the essential difference betwixt Natural and Artificial things &c. a too plausible despondency; *a* want of belief that Physicks much concern'd their Interests; *want* of Encouragement; *want* of Natural History; *want* of Curiosity; *want* of a method of Enquiring; *want* of a Method of Experimenting; *want* of a Physical *Logick*; *want* of Mathematicks, and Mechanicks; *want* of associated Endeavours; to all which but too many other particulars might be added.

2. You will not think it strange, that in the following Tracts much of the Usefulness, for which I would recommend Physicks, supposes future Proficiency in them, if you consider the nature of my Design; which is not to make an *Elogium* of Natural Philosophy imperfect as it *yet is*, but to
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shew that as it *may be*, and probably *will be*, improv'd, it may afford considerable advantages to Mankind. And since, as I long agoe intimated to you, my purpose in this Book is to invite you, and assist you to invite other Ingenious men to a farther study of Nature, tis very agreeable to my Design to represent the greatest Benefits I make it promise You, as Effects and Recompences of your future Attainments; and I should allowably enough discharge my part in this Treatise, if I should not do any more (which yet I hope I shall do) than give you Reasonable inducements to entertain high Expectations of the Fruits, that may be gathered from Natural Philosophie, if it be industriously and skilfully cultivated: and the very rendring such an Expectation probable, I take to be a good step towards the attainment of the things expected; many of which would questionlesse be obtain'd, if men were thoroughly perswaded that they are most worthy to be endeavour'd, and very possible to be compass'd. And therefore I wonder not, that so Judicious a Friend to Philosophie and Mankind as Sir Francis Bacon, should in several places represent mens Opinions of the Impossibility of doing Great matters of the nature of those things we are speaking of, as One of the chief Obstacles to the advancement of real and useful Learning: and I the rather insist on the things that may heighten your Expectations, *not onely* because many prudent and Learned men, who have been bred in the Philosophie of the Schools, are apt to judg of all Philosophie by that which for so many Ages has been barren, as to useful Productions, (though fruitful enough in Controversies,) *but* because I have met with some morose Authors, and others as despondent persons, who because they have unsuccessfully attempted to perform some things according to the Prescriptions of some unfaithful Writers of Natural Philosophie, fall presently to believe themselves, and to perswade others, That nothing Considerable is now (at least without

almost insuperable difficulties) to be perform'd by Natural Philosophie it self, especially whilst men amuse themselves about Speculations and Trials that seem not to tend directly to Practice; our Ancestors having had the luck to light upon all the *profitable* Inventions, which skill in Physiologie is able to supply Mankind with. But (to take notice first of what was last suggested) *I* make no doubt but that many Experiments, whereby men are not presently enabled to do what they could not before, may yet be very useful to mens interests by discovering or illustrating the Nature or Causes of things. For though that famous Distinction, introduc'd by the Lord *Verulam*, whereby Experiments are sort-ed into *Luciferous* and *Fructiferous*, may be (if rightly understood) of commendable Use; yet it would much mislead those that should so understand it, as if *Fructiferous* Experiments did so meerly advantage our interests, as not to promote our Knowledge; or the Experiments called *Luciferous*, did so barely enrich our Understandings, as to be no other waies useful. For though some Experiments may be fitly enough call'd *Luciferous*, and others *Fructiferous*, because the more obvious and immediate Effect of the One is to discover to us Physiological Truths, and of the other to enable us to perform something of Use to the Possessor, yet certainly there are few *Fructiferous* Experiments, which may not readily become *Luciferous* to the attentive Considerer of them. For by being able to produce unusual Effects, they either hint to us the Causes of them, or at least acquaint us with some of the Properties or Qualities of the things concurring to the production of such Effects. And on the other side those Experiments, whose more obvious use is to detect to us the Nature or Causes of things, may be, though lesse directly, and in somewhat a remoter way, exceedingly *Fructiferous*. For since, as *I* have formerly observ'd, man's Power over the Creatures consists in his Knowledge of them;

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whatever does increase his Knowledge, does proportionately increase his Power. And perhaps I should not much Hyperbolize, if I should venture to say, that there is scarce any considerable Physical Truth, which is not, as it were, seeming with profitable Inventions, and may not by humane Skill and industry be made the fruitful Mother of divers things useful, either to Mankind in general, or at least to the particular Discoverer and dexterous Applyer of that Truth. To countenance this Opinion of Mine, I have already given you some instances, and reserve more for the last Essayes of this Treatise; especially having observ'd it to have been a fault, which though prejudicial enough to the interest of Mankind, is very incident to the more sober and severe sort of Philosophers, and perhaps more to Them, than to Others, to conclude every thing to be Impossible, or at least unfit to be attempted, that cannot be perform'd by the already known Qualities of Things and Wayes of applying them: without considering, That as many Simples of excellent Virtues grow in Wilderesses, and not by the High-ways side, so diverse admirable Properties of things may be found, out of the customary progresse or beaten Rodes (if I may so speak) of Nature. And that Philosophers are oftentimes deceiv'd, when they think they have made a true and perfect *Analysis* of the possible wayes, whereby such and such Effects may be produc'd. For Nature by her Subtlety oftentimes transcends and illudes the greatest subtlety of humane Ratiocinations. And as she may have quite other wayes of working, than we are aware of, so the knowledge of some peculiar and conceal'd property of a Thing, may enable them that are acquainted with it, to perform that with ease, which by the known Qualities of things, is either not at all to be perform'd, or not without great Difficulty.

This seeming Paradox you may find in due place confirm'd; and in the mean while to return to those Learned men

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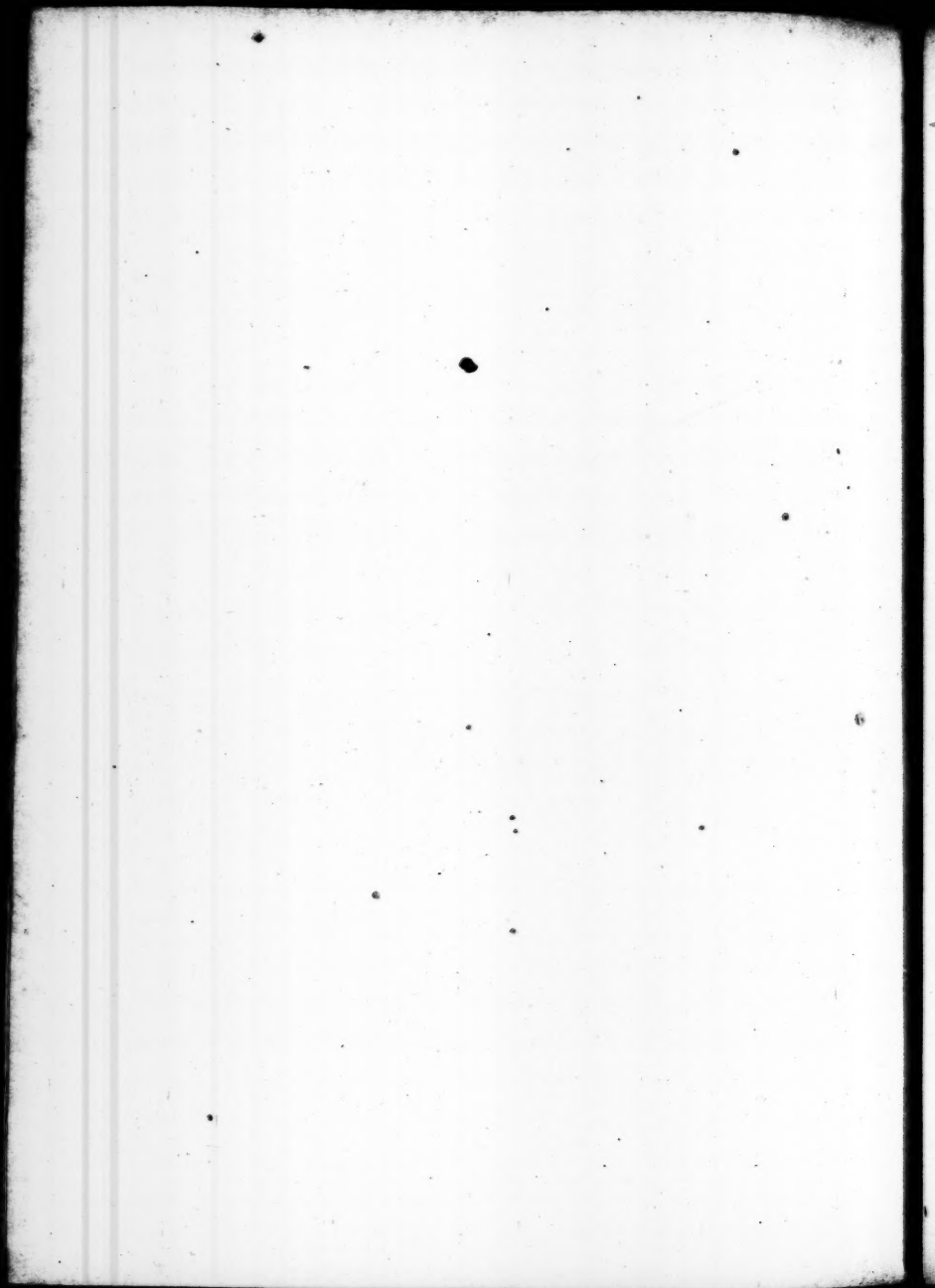
men, who having attempted some things, and possibly perform'd a few in Natural Philosophy, would keep the world from expecting any great matters from it, I shall venture to say of them, That *as* the Jewish Spies though they brought their Countrey-men out of the Land of *Canaan* some few of the goodly Fruits of that Soyl, yet bringing them withall a discouraging account of the difficulties they were like to meet with in conquering it, did the *Israelites* more harm by their Despondency, than Good by their Fruits; so divers of the Authors we are speaking of, though they may have presented us with some acceptable Fruits of their Enquiry into Experimental Learning, yet by bringing up an ill report concerning the studie of it, and thereby deterring irresolute Persons from addiſting themselves seriously to it, they have more prejudic'd them by their Despondency, than advantag'd them by their Experiments. And though I dare not, a Chymist would not, scruple to pursue the *Simile*, and tell you, that as onely those two of the Spies, *Caleb* and *Joshua*, who made no doubt but that they should conquer the fertile (though never so well fortified) Land of *Canaan*, did really possess it, all their disanimated Brethren wandering and dying in the Wildernesse; so none but those Generous Attempters, that dare boldly venture upon the Difficulties that surround the knowledg of Nature, are like prosperously to overcome them, and possesse what they contend for.

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29, 30.

But I must leave this Digression to proceed to the last Advertisement I am to give you, which is, that I know you may (possibly) expect that I should say something to You distinctly of the chief Means by which the Naturalist may probably advance Trades, and assist Man, by the blessing of the Author of Nature, to recover part of his lost Empire over the works of Nature. And I confesse, I have more than once had thoughts of a kind of Project (if I may so call it) for the Advance of Experimental Philosophy, consisting of

of such Heads as these: A Prospect of what probably MAY be attain'd to in Physicks (both as to Theory and Practice.) A summary account of What IS attain'd already. *The Imperfectness* of our present attainments. *What Helps* men now enjoy. *The Incompetency* of our present Helps. *The Hindrances* and the Causes of them. And *The Means* and Helps that MAY be employ'd. To which other Heads might in case of need be added. But notwithstanding the expectations you may have, that I should handle such subjects, and the Thoughts I have had about them, I purposely wav'd the treating of them by themselves in the ensuing ESSAYES, partly, because these unelaborate Discourses are not design'd for a just Treatise on the Subjects handled in them, containing but such loose Experiments and Observations, as could without too much impoverishing other Papers, be put together on this occasion; and partly, because I have in effect bin careful to mention several of those things, that you might expect to find separately treated of; but knowing that a far lesse discerning eye than yours may easily, if there be occasion, distinguish them, I thought it more convenient to interweave them with the other parts of the following Discourse, since every proposition of a probable way to Improve Philosophie, is also a ground of expecting those advantages that may be hop'd for from Philosophie Improved.





Of the VSEFULNESSE of
MATHEMATICKS
TO
Natural Philosophy.

OF THE VARIATIONS OF
MATHEMATICS
TO
Natural Philosophy.

Of the Usefulness of MATHEMATICKS to
NATURAL PHILOSOPHIE,

OR

That the Empire of Man may be promoted by the Naturalist's
skill in Mathematicks, (as well Pure, as Mixt.)

[Fit were not allowable for any but those that are thoroughly skill'd in the abstruser Mysteries of the Mathematicks, to discourse of those Disciplines; the Title of this Essay would I fear (*Pyrophilus*) make you think me guilty of Presumption, since you may perchance remember, that when you were conversant about those Studies, I confess'd to you, that the great Authority of some famous Modern Naturalists had, for a while, diverted me from making any great Progress in those Sciences, by their resolute denying them to be useful to Physiologie. But as I do not pretend to have taken that pains, which else I might have done, to become a Speculative Geometrician; so I consider, that without understanding as much of the abstruser part of Geometrie, as *Archimedes*, or *Apollonius*, one may understand enough to be assisted by it in the Contemplation of Nature; and that one needs not know the profoundest Mysteries of it, to be able to discern its Usefulness. And therefore I shall venture to propound something to you concerning this last nam'd Subject, especially since otherwise you may be influenc'd, as I once was, by the great Authority of those Modern Philosophers, who would have the use of Mathematicks, as Disciplines that consider onely Abstracted Quantity and Figure, to be rather hurtful than advantageous to a Naturalist, the Object of whose Studies ought to be

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Matter. But though these endeavour to keep men from thinking the Mathematicks to be of any great Use toward making a Man a good Naturalist, by alledging the extravagant Opinions that *Kepler* himself, who was Mathematician to three Emperours, and some other Modern Astronomers, have broach'd or maintain'd concerning matters Physiogical; yet I confesse, that after I began, by reflecting upon divers of my Experiments, especially Mechanical, to discern how useful Mathematicks may be made to Physicks; I have often wish'd that I had imploy'd about the Speculative part of Geometrie, and the cultivating of the Specious Algebra I had been taught very young, a good part of that Time and Industry that I spent about Surveying and Fortification, (of which I remember I once wrot an entire Treatise) and other Practick parts of Mathematicks. And indeed I think, that a Competent Knowledge in Mathematicks (for a Profound one is not always necessary) may be so serviceable to those that would become Philosophers, that I shall not scruple to mention it as another thing which may increase your Expectation from Physiologie, That those who pass for Naturalists have, for the most part, been very little, or not at all, vers'd in the Mathematicks, if not also Jealous of them. And I the less scruple to write to you on this Subject, because I do not know that others have prevented me: For though the Learned *Clavius*, and some other Expositors of *Euclid*, have said much of the Usefulness of Geometrie to other Mathematical Disciplines, and though not a little has been said in the praise of Mathematicks in general; yet tis left free for me to discourse to you of (what is the Subject of this Essay) the Utility of Mathematicks in reference to Modern Physicks, and therein not onely to the Notions of the Corpuscular Philosophie, but even to Practicall and Experimental Knowledge.

Now there are are several Scores, upon which skill in Mathematicks

thematically may be useful to the Experimental Philosopher. For there are some general Advantages, which Mathematicks may bring to the Minds of men, to whatever Study they apply themselves, and consequently to the Students of Natural Philosophie; namely, that these Disciplines are wont to make men accurate, and very attentive to the Employment they are about, keeping their Thoughts from wandering, and inuring them to Patience of going through with tedious and intricate Demonstrations; besides, that they much improve Reason, by accustoming the mind to deduce successive Consequences, and judg of them without easily acquiescing in any thing but Demonstration.

And indeed the Operations of Symbolical Arithmetick (or the modern Algebra) seem to me to afford men one of the clearest Exercises of Reason that I ever yet met with, nothing being there to be perform'd without strict and watchful Ratiocination, and the whole method and progress of that appearing at once upon the Paper when the Operation is finish'd, and affording the *Analyst* a lasting, and, as it were, visible Ratiocination.

But, *Pyrophilus*, I may not insist on these, or the like general Uses of pure Mathematicks, since there are divers others, which more immediately respect Natural Philosophie.

And to shew this the better, give me leave to premise to the following Particulars a couple of Observations.

The first is, That the *Phænomena*, which the Mathematician concurs to exhibit, do really belong to the Cognizance of the Naturalist. For when Matter comes once to be endow'd with Qualities, the Consideration how it came by them, is a Question rather about the Agent or Efficient, than the nature of the Body it self. So the Image or Picture, that a man sees of his Face in a Looking Glass, though that be an Artificial Body, falls as well under the Speculation of the Naturalist, as when the like Picture is presented him by
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calm and clear Water. And the Rain-Bows that are often artificially made in Grotto's, by dispersing the water of Fountains into Drops and Showers, have a just Title to his Contemplation, as well as the Rain-bow that is form'd in the Clouds. And the Eccho's that are admir'd in some of those Grotto's, purposely and artificially contriv'd to afford rare ones, do as well belong to his cognizance, as those that Nature makes in ruder Dens, and other Cavities of Hills and Mountains. And indeed most of those *Phænomena* require (for the main) the same Solutions, whether the skill of man do or do not intervene to exhibit them.

The second Consideration, which I am often oblig'd to repeat, is this; That since Man's power over the Creatures depends chiefly upon his Knowledge of them, whatever serves to increase considerably his Knowledge, is likely either directly or in its consequences to adde to his Power; which two Advertisements being thus given you, *Pyrophilus*, I now advance to the particulars, whose mention they made me suspend.

1. And first, these Disciplines teach men the Nature and Properties of Figures, both upon Surfaces and Solids, and the Relations (for they can scarce be properly called *Proportions*) betwixt the Surface and Solidity of the same Body. 'Tis true, that *Matter*, or Body, is the subject of the Naturalist's Speculations; but if it be also true, that most, if not all the Operations of the parcels of that Matter (that is, of Natural Bodies) one upon another, depend upon those Modifications, which their Local Motion receives from their Magnitude and their Figure, as the chief Mechanical Affections of the parts of Matter; it can scarce be denied, that the knowledge of what *Figures* are, (for instance) more or less capacious, and advantag'd or disadvantage'd, for Motion or for Rest, or for penetrating or resisting Penetration, or for the being fasten'd to another &c. must be of considerable Use
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in explicating many of the *Phænomena* of Nature; and tis sufficiently known, how much of the Doctrine of Figures may be learn'd from Geometricians, who treating expressly and copiously of Triangles, Circles, Surfaces Elliptical, Parabolical, Hyperbolical, and other plain Figures; as also of Spheres, Cones, Cylinders, and especially Prisms, Pyramids, Cubes, and regular Bodies, intimate also the Methods of judging of the Figures of other Bodies, that are either compos'd of them, or may, by reason of some Analogie, be refer'd to them.

There are divers Properties as well of Planes and Solid figures, and their Habitudes to each other; as of such Lines as are describ'd by Motions, or wherein Motions may be made: the knowledg whereof may be of good use not onely to the Speculative Naturalist, but the Practical.

To know the Proportion that *Archimedes* has demonstrated to be between a Sphere and a Cylinder, and either of those to a Cone so and so qualified; or to know, that a Triangular Pyramid is the third part of a Prisme, having the same Base and Height; and in a word, to know the Proportions between Geometrical Bodies, may sometimes be of good use, in cases where we can procure the one, and not the other, or at least not so well as the other. Of this an Instance is given us by the Ingenious *Marinus Ghetaldus*, (as I find him cited by a late Mathematician) who tels us, that *Ghetaldus* finding it very difficult to procure an exact Metalline Sphere, wherewith to examine the proportion in point of weight between heavy Bodies of the same Bulk, found that yet he could get a Cylinder of Tin to be turn'd true; and having therewith made his Experiments or Observations, 'twas easie for him, knowing out of his *Archimedes*, that the proportion of a Cylinder, whose Basis is equal to one of the great Circles of a Sphere, and whose Height is equal to the Diameter of that Sphere, is to that Sphere in

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ratione sesquialtera, as they speak, *i.e.* has the same proportion that three has to two; it was, I say, easier for him, who had often had occasion to weigh his Cylinder exactly, by subtracting a third part of the whole weight, to find in the remainder the desir'd weight of a Sphere of Tin, whose Diameter was equal to that of the Basis, or to the height of the Cylinder: which weight of a Sphere of a known Diameter being once obtain'd, he deduc'd from them the weights of the other Spheres he had occasion to imploy, about the construction of those Tables, which have been much made use of by divers succeeding Mathematicians. And what Applications I have made of the same *Archimedean* Theorem, I may elsewhere inform you.

It being also taken for granted by divers Modern Geometricians and Engineers, that the Excellent *Galilao*, and his not degenerate Disciple, *Torricellius*, had demonstrated the Line which a Heavy body, projected, and even the Bullet, shot out of a Cannon, describes, to be Parabolical; it may be of moment in the practice of Gunnery, and in reference to divers Experiments to be made with other projected Bodies, to be well vers'd in the nature of the Parabola and Parabolical Lines, which are also thought to be capable of doing Wonders in Burning-glasses, in case these Metalline *Specula* can be brought to a Parabolical Figure; one of whose remarkable properties is, That all the Beams that, being parallel to the *Axis*, fall upon the Internal Superficies, are reflected to one point or *focus*; where consequently, if the Burning-glass be any thing large, the Heat must be very intense, especially in comparison of a Spherical Burning-glass of the same bigness.

And as for delightful and Recreative Experiments, you will easily allow me, that there are abundance of Catoptrical ones of that sort, which depend upon the figure of Spherical, Cylindrical, and other sorts of Reflecting Glasses.

2. I might here tell you, *Pyrophilus*, that pure Mathematicks themselves, setting aside the assistance they are wont to give to mixt Mathematicks, may be of use to Humane Life, and to the Experimental Naturalist; of which I shall give you, as a Specimen, this notable Example.

The properties of Arithmetical and Geometrical Progressions in Numbers, seem to have very little to do with the Practice of weighing out things in Shops and Warehouses. And yet by the knowledg of the Double Progression, beginning from an Unite, (as Arithmeticians call that, wherein the Consequent is still double to the Antecedent) as 1. 2. 4. 8. a great deal of Cumber, and sometimes of Charge, may be sav'd. For with 3 Weights you may weigh all the Pounds, that are from 1 to 7 inclusively; with 4 Weights, all those that exceed not 15 pound; upon which observation is grounded the Division of some Boxes or Sets of Weights, us'd by our Goldsmiths. And if you would, as is very usual, put Weights (when there is occasion) in both Scales, to help the thing to be weigh'd to bring the Balance to an *Equilibrium*, then the Triple Progression (*i. e.* where the Numbers increase in a triple proportion, as 1. 3. 9.) has a much more notable property for our purpose; by considering which, the Industrious *Stifelius* concluded, that by 3 Weights, you may weigh any number of Pounds from One to 13 inclusively; with 4 Weights, any number of pounds from 1 to 40 inclusively; with 5 Weights, any number of pounds not exceeding Sixscore and One; and with but 6 Weights, any number of pounds from 1 to 364. But the method of ordering so few Weights to serve so many purposes, is best found out by Symbolical Arithmetick, or Algebra, by which I have taken pleasure to work so fine a Problem; which, because tis applicable not onely to Pounds,

but to the parts of pounds, and those of differing Denominations, it may be of so great Use to you, if ever you busie your self about Statical Experiments, that I shall to the end of this Essay annex a Table, to shew, what Weights are to be taken in every possible case, which I found ready calculated to my hand by the Ingenious *Franciscus a Schooten*, Professor of Mathematicks at *Leyden*.

To the former Instance, of the Use that an Experimenter may make of pure Mathematicks, I might, if it could be sufficiently deliver'd in few words, adde the method of computing the Combinations, that may be made of any number of things propos'd, which some Mathematicians call *Regula Combinatoria*. For though I remember not to have found this Method fully handled in any one Author, even among the modern Algebricians; yet, as it is deliver'd by some Arithmeticians, it is by no means to be despis'd, but, as it may be managed by Symbolical Arithmetick, it will, if I mistake not, want nothing, but the being skillfully applied by the Naturalist, to be on certain occasions very serviceable to him.

3. We may take notice in the next place, that Mathematicks may much help the Naturalist, both to frame *Hypotheses*, and judg of those that are propos'd to him, especially such as relate to Mathematical subjects in conjunction with others.

What wretched Theories the Ignorance of Mathematicks has made Naturalists, otherwise very considerable in their way, frame and propose, may be evidently shewn in the Accounts that *Epicurus*, and his Paraphrast *Lucretius*, give of the Sun, and other Celestial Bodies. And indeed what satisfactory Account can be given of the varying Lengths and Vicissitudes of Dayes and Nights, and the Eclipses of the Sun

Sun and Moon, the Stations and Retrogradations observ'd in Planets, and other familiar Cœlestial *Phænomena*, without supposing these great Mundan Bodies to have such Scituations in respect to one another, and to move in such Lines, (or at least be made to appear to move in them by the motion of the Earth in such a position, and in such Lines?) nay how without the knowledg of the Doctrine of the Sphere will the Naturalist be able to make any sober and well grounded Judgment in that grand and noble Problem, *which is the true Systeme of the World?* which is indeavour'd to be solv'd after such differing manners by the *Ptolomeans* and *Peripateticks*, by the *Tychonians* and by the *Copernicans* (both lesse and more modern.)

That (then) the knowledg of Celestial Bodies is not well to be attain'd, nor consequently the Theories, propos'd of them, to be intelligently judg'd of, without Arithmetick and Geometrie, (those Wings, on which the Astronomer soars as high as Heaven,) he must be very little acquainted with Astronomie, and particularly with the various, and, too often, intricate Theories of Planets, that can doubt. And truly, when I consider the astonishing distance and immensity of the Celestial Bodies, and those almost numberles fix'd Stars (each of them perhaps much vaster than the whole Earth,) which in a clear Night I take pleasure to gaze at through the better sort of Telescopes, both in the Milky way, and in other parts of the Sky, that seem not so much as whitish to our Eyes; I cannot but highly prize a Science, that acquaints us, that what we know of so much of the Universe as the Globe we inhabit and call the World, is but a Point to it, taking up a little more room in it, than a Physical Center in the Sphere.

The Usefulness also of pure Mathematicks to Geographie is likewise evident; and sure inquisitive men ought not to

despise this and the former part of Learning, without which, as I was lately saying, they cannot know so much as whether the Earth we live upon, moves or stands still?

There are also divers *Phænomena* of Nature, that are neither Astronomical, nor Geographical, where the Usefulness of Mathematicks is manifest enough. For as to the *Phænomena* of that Sense, to which the Naturalist is most beholding, *Sight*, what a pittiful Account is given of them by those *Aristotelians*, Physicians, and other Writers, without excepting many good Anatomists, that have been strangers to Mathematicks, in comparison of what has been done (not to mention *Euclid*, *Alhazen*, and *Vitelius*) by *Kepler*, *Scheiner*, *Herrigon*, and some other modern Mathematicians.

And tis evident to those that are acquainted with Dioptricks, that without some knowledg not onely of the properties of Convex Bodies, and of the Laws of Refraction from and towards the Perpendicular, (as the Masters of Opticks speak) but also of the properties of Lines, as Circular, Parabolical, Hyperbolical, &c. and Figures, as Ellipses, Circles, Parabola's, Hyperbola's, &c. tis almost impossible, either well to explicate most of the *Phænomena* of that noblest of our Senses, *Sight* it self, or to make a well grounded judgment of others Explications of them. He that is altogether a Stranger to this part of Mathematicks, will scarce be able to conceive the Reason of the admirable Fabrick of the Eye, and how the ChrySTALLINE Humor does by its Convex Figure (like a Lenticular Glass) refract and converge the Beams, (or at least the Pencils) that proceed from the visible Object, that they may paint the more lively picture of it upon the *Retina* at the bottom of the Eye: nor will he understand why, by reason of the Decussation of the
Beams

Beams within the Eye, this Picture must be made inverted, though we apprehend the Objects themselves in a right posture; nor why small Objects, plac'd near the Eye, where they are seen under a wide Angle, appear as big, as very much greater that are seen at a greater distance from it. And much less will he be able to understand the reason of those many Delusive Apparitions, exhibited by Concave, Convex, Conical, and Cylindrical Glasses; the Catoptricks, or *Doctrine of Reflex vision*, belonging yet more to the Mathematicks than Dioptricks do.

4. And *since* that from the Magnitudes of divers Bodies, or of several parts of the same Body, and so likewise from their degrees of Celerity in their Motion, there will arise a certain Respect, which if they be but two, Geometricians call a *Ratio*, and if more than two, a *Proportion*, (though these Terms are oftentimes confounded, and promiscuously employ'd by Authors:) and *since* Proportion is so frequently to be met with in the Works of Him, who by an Eminent, though Apocryphal Writer, is truly said to have *made all things in Number, Weight, and Measure*; and *since* the Doctrine of Proportion, as such, belongs to the Mathematician as the Noblest part of those Sciences he treats of; I think it may safely enough be affirm'd, that he that is not so much as indifferently skill'd in Mathematicks, can hardly be more than indifferently skill'd in the fundamental principles of Physiologie. Nor perhaps would it be rash to say, that the Fifth Book of *Euclid's Elements*, where the Doctrine of Proportions is chiefly deliver'd, may prove more instructive to the Naturalist, than the Fifth Book of *Aristotle's Physics*. And therefore I do not so much wonder, that *Plato* should over the Gate of his School place an Inscription, (*ἡμεῖς μὲν οὐκ ἐγγίσιμι*) forbidding the Entrance to persons unacquainted.

quainted with Geometrie, as unfit to judg of what was there taught.

Nay this, though you may think it strange, is very true, that there are some considerable *Phænomena* of Nature, which are so far from being Explicable by their Causes, that men cannot so much as understand what is Meant by them, without some knowledg of the Doctrine of Proportions. As, for Instance, when the Teacher of Opticks tell us, that the Increments of Light are *in duplicatâ ratione distantiarum, secundum quas à Corporibus recedant, à quibus primum efficiuntur*. He that knows nothing of Proportions, cannot tell so much as what they mean by this Theorem, much less whether or no it be true. And so, when the same Proposition is by the diligent *Mersennus* apply'd also to Sounds, a common Reader would not at all understand him, if he did not adde by way of Explanation, that if, for Instance, the Noise of a peece of Ordinance be heard a League off, that Noise will be four times stronger, if it be heard but at the distance of half a League. Nor will this Example it self give such a Reader, as we speak of, a clear understanding of the propos'd Theorem. But a considerabler Instance in this kind may be afforded us by the noble Discovery of the Moderns, especially *Galilæo*, who observe, that when a heavy Body descends through the Air, the Spaces pass through, from the beginning to the end of the Motion, are among themselves in a (not double but) *duplicate* Ratio of the Moments or equal Divisions of Time spent in the fall; which requires the knowledg of what a *Duplicate* Proportion is, to be well understood: But it may in some sort be explain'd, (and so noble a *Phænomenon* must not be here omitted,) by saying, that *Galilæo* affirms himself to have observ'd, that a Brass Bullet of 100 pound will, in the space of one Minute of

*Harmonic. lib. 1.
Prop. 12.*

of an Hour, descend an hundred *Florentine* Cubits, (which some reckon to be 180 Feet of ours,) and consequently, saith *Mersennus*, four Cubits in one Second, or sixtieth part of a Minute; and by adding, that the Bullet falls in such a *Ratio*, that the acceleration of the Motion is made according to the progression of odd Numbers, beginning from an *Unit*, or One; so that if in the first moment of time the Weight fall down one Fathom, in the 2^d moment it must descend three Fathom; in the 3^d, 5 Fathom; in the 4th, 7; in the 5th, Nine; in the 6th, Eleven; and so onward. Whence *Mersennus* gives this Rule, to know how far the Weight will descend in a determinate time assign'd; and by knowing how far it has descended, to calculate how long it was in falling. *Regula generalis*, says he, *hac est. Si dentur tempora, & quantur spatia, quadrentur tempora & habebuntur rationes spatiorum. Si dentur spatia, & quantur tempora, investigetur latus spatiorum, & dabitur ratio temporum.*

*Mersen. Hav-
moa. lib. 2. Pro-
pos. 24. Corollar.
1.*

Divers other Instances might be produc'd, to manifest the requisitenes and advantagiousnes of some knowledg in Mathematicks to a Speculative Naturalist: But I shall content my self to name one more, viz. that the grand Theorem or Rule of the Staticks, That in the *Ballance*, or resembling Instruments, the *Proportion betwixt the equivalent Weights, and their distances from the fulcimentum or Prop, is reciprocal*, (so that tis usual with Butchers, and other Tradesmen, to weigh in the *Statera*, commonly call'd the *Styliards*, 10 or 20 pound weight, for Instance, hung neer the *Fulciment*, with one pound weight, plac'd on the other side of the *Beam*, at 10 or 20 times distance from it,) and many other Theorems, that serve to explicate the properties of the grand Instrument of Nature; Motion, (especially as produc'd or modify'd by Weight, or equivalent Force variously adapted, and

and apply'd) cannot well be understood without an Insight into Geometrie, and especially the Doctrine of Proportions; and how much the knowledge of the Principles and Theorems of the Mechanicks may assist the Naturalist both to explicate many of Natures *Phænomena*, and to try Experiments, and work great Changes on her Productions, men will then more readily confess, when they shall better discern how many of her works are but Engines, and do operate accordingly.

5. And give me leave, *Pyrophilus*, to adde in this place, that the Doctrine of Proportions, as it is the Soul of the Mathematicks themselves, so it may be of vast (though perhaps yet unheeded) Use in Physiologie too; not onely as it helps the Naturalist (as we have newly seen it does) to understand divers *Phænomena* of Nature, but as it may enable him to perform divers things, which he could not perform without it; of which, though I may have occasion to give you hereafter in other papers several Examples, yet I shall now mention two or three for Illustration sake.

That the Pendulum is the accuratest Instrument that we yet have of measuring short spaces of Time, I presume you do not doubt: and I need not tell you, that he who would know what Length a Pendulum must be of, to measure by its Swing some determinate space of Time, as, for Instance, a half Second, (or half the sixtieth part of a Minute,) must find it out by Trial and Observation, if he be not unacquainted with the Doctrine of Proportions: but in case he is vers'd in that, as well as in the *Phænomena* of Pendulums, he may from the length of one Pendulum, that exactly measures a known part of Time, without making particular Tryals and Observations, deduce the length of Pendulums that will serve to measure other Divisions of Time. For Instance, that

that diligent Observer *Merjennus* assures us, that he found by frequent Tryals, that a slender String with a Pistol or Musket Bullet at the end of it, whose Length comprehending the Bullet was 3 Foot and a half, (elsewhere he mentions 3 Foot and a 27th) vibrates Second (Minutes:) This now being taken for granted, and it being a receiv'd Theorem concerning Pendulums alike in all things but Length, *That the Lengths are in Duplicate Proportion to the times in which their Vibrations are respectively perform'd*, or are as the Squares of the Vibrations they performe in the same time, and consequently, the times are in Subduplicate Proportion to the lengths of the Pendulums, if a man would (as I was saying) have a Pendulum that shall vibrate Half-seconds, he must not take, as one unacquainted with these things would be apt to do, a Pendulum of a Foot and $\frac{1}{4}$, which is $\frac{1}{2}$ the length of that which vibrates a whole Second, for such a Pendulum would prove much too long for his purpose, nor need he by multiply'd observations laboriously find out how much it is too long, (which oftentimes for want of a Standard he cannot do,) but since the proportion between a Second and $\frac{1}{2}$ a Second is double, and the proportion betwixt the length of the Strings, that are to vibrate these two differing spaces of time, must be Duplicate of the proportion of the times themselves, it follows, that the length of the Strings must be as 4 to one, (which is the Duplicate of the proportion of 2 to 1,) and so the length of the shorter String must be but a $\frac{1}{4}$ of that of the longer.

This, if it were needful, might be confirm'd by a Probleme of the Learned *Ricciolo's*, whereof I shall here give you an Example, because I may hereafter have occasion to shew you the farther use of it. Let us then suppose, to avoid fractions, that a Pendulum that vibrates Seconds, is 3 entire

Foot long, (as indeed some modern Mathematicians tell us it is and as it may well be according to the measure us'd in some places.) If then you multiply 3690 the Square of the Vibrations, (which are 60,) that your 3 foot Pendulum makes in a Second, by the length of the Pendulum, which is 36 Inches, and divide the Product (viz. 129600) by 9 Inches, the 4th part of the length of the former Pendulum; and if lastly, of the Quorient (14400) you extract the Square root, you shall find it to be 120, that gives you the number of Vibrations that will be made in a Second by a Pendulum of 9 Inches long, and this Root being 20, which is the double of 10, you may see, that to make a Pendulum, that shall vibrate Half-Seconds, it must be but $\frac{1}{4}$ as long as that which vibrates whole Seconds. And if I thought you were like to think these Rules as strange, as a person wholly unacquainted with the nature of Pendulums, and the Doctrine of Proportions may do; I would invite you to consult Experience, as I have purposely done in differing Pendulums, that divide a Minute into Seconds, Half seconds, and Quarter-Seconds; since though your Tryals should not be very nicely made, they may suffice to perswade you, that the above mention'd Rules are either accurately true, or at least true for the main, and therefore true enough to be very useful in many occurrences.

To the above mention'd Instances afforded by Pendulums I shall here adde but one more, that comprehends many thousands; for the Art of composing of that great variety of Harmonious Tunes, that makes Musick so delightful to us, depends upon the Doctrine of Proportions. And he that being well skill'd in that, knows how to apply it to the Notes or Words propos'd, according to the Observations which Experience has afforded, of the gratefulness of such
and

and such Consonancies &c. may out of his own head compose a strange variety of new and pleasing Tunes, which are in many Exercises that man makes of the power his Skill gives him over the Bodies of which his Musical Instruments consist, and over those which they affect.

6. I know not, *Pyrophilus*, whether I may not reckon amongst the Advantages that Mathematicks may afford the Naturalist, That they will in many cases suggest to him divers new Experiments, whereby to vary those wherein the Figures of Bodies, the Lines of Motion, as also Numbers, Proportions, and the like Affections, which the Mathematician is wont to treat of, may come into consideration. For 'tis very likely, that those suggested Experiments, which either would not be thought on, or could not be skilfully propos'd, by a person not vers'd in Mathematicks, may, either immediately, or upon the score of the Applications that may be made of them, prove serviceable to men: (of which I hope in one of the following Essays, to give you some Instances.)

See the IX
Essay.

I care not to mention to you, how great a variety of Tryals and Observations, about the best way of Levelling great Guns, and the differing Distances to which they will carry at such and such Elevations, and the Lines describ'd by the motion of the Bullet, and other particulars belonging to the Art of Gunnery, have been propos'd and try'd, upon the Hints suggested by Geometrie's Mathematical Disciples (especially,) and others, because many Good men with these fatal Arts had been less understood. And therefore I shall rather put you in mind of the great variety of *Phænomena*, which pure Mathematicks have help'd men to discover and derive from these familiar Observations; That a Beam of Light, passing through differing *Mediums*, is not continued in a streight Line, but broken or refracted; and, That in

such and such conjunctions of Circumstances the Sun or Moon will suffer an Eclipse, that will obscure such a part of the Body, and last from such a time to such a time: from which Observations of Eclipses divers very considerable things have been deduc'd by Mathematicians, not onely as to Astronomy, but also Geographie, Navigation, and Chronologie. And he that considers what the Doctrine of Proportions, and of Concords (or, as our Musicians call them, Cords,) and Discords, has contributed to the great number of Musical Instruments, that have been actually made, and delightfully practis'd, and that it may afford the Naturalist divers Hints applicable to other purposes, (which I shall hereafter have occasion to intimate,) He, I say, that considers these things, especially if he be also acquainted with Ingenious, pleasant, and some of them useful, Experiments, that have been or may be deriv'd from the Observations, That when a Beam of Light falls upon a Body, and rebounds from it, the Angle of Incidence is equal to that of Reflection; That if the Superficies of the Body be Curve, the Angle is to be estimated as if it fell upon a Tangent to that Superficies; That if the Beam penetrate the Body, and come to it through a thinner *medium*, tis refracted towards the Perpendicular, if through a thicker *medium*, from the Perpendicular; He, as I was saying, that shall consider These things, and withall what a great variety of Propositions, as well Problems as Theorems, have been deduc'd by Mathematicians by the help of these few Observations, and of as few Propositions touching the place of the Object seen by the help of Specular and Dioptrical Glasses, will easily grant; what by so many Instances I have been endeavouring to prove.

7. I come now to the Consideration, wherewith I shall conclude

conclude this Essay, *viz.* That divers Disciplines that are reckon'd amongst the mixt Mathematicks, are chiefly Practical, and may assist the Naturalist in making Experiments and Observations, which he either could not make, or could not make so accurately without them: As may appear, *partly* by the Art of Dialling, which teaches how to measure Time, and tends chiefly to practice; *partly* by the Art of Perspective, which is of great use to represent Solids and Distances upon a small and plain Superficies, and is very serviceable to the Limners Art; wherein if Schollars and Travellers were more generally conversant, the History of Nature would be far better adorn'd with lively representations of Plants, Animals, Meteors, &c. and also by several parts of the Art of Navigation, and particularly that which they call *Hiftriadròmia*, or the Doctrine of the Lines by which Pilots make their Ships to sail. Now if in these, and divers other Instances that may be given, it must be acknowledg'd, that mixt Mathematicks may be serviceable to the Naturalist; and assist him to promote the Empire of Man; it ought not to be denied, that pure Mathematicks themselves, as vulgar Arithmetick, Geometrie, and Algebra, may be of Use to the Naturalist, since tis from those Speculative parts of the Mathematicks, that not onely these other more Practical Disciplines are deriv'd; but a greater number of those Disciplines that are called mixt Mathematicks, may, according to what I elswhere observe, be hoped for. For as Sounds and pure Mathematicks make up Musick, and Water with the same Sciences make Hydrostaticks; so, as I elswhere note, by a further Application of the same parts of Knowledge to other Subjects, (and in some cases even to the *same*;) those Disciplines that are call'd Mixt Mathematicks, may be advanc'd probably as to Number, as well as certainly as to Usefulness

Usefulnesses and Variety of Experiments. Nor is it onely in those parts of Learning, that I have now particularly nam'd, that useful Applications may be made of the Theorems and Problems of pure Mathematicks, since upon these sublimie Sciences do also in great part depend those other Mathematical Disciplines, which are wont (by a *Synecdoche*) to be call'd Mechanical, and which tis now time that I passe on to consider.



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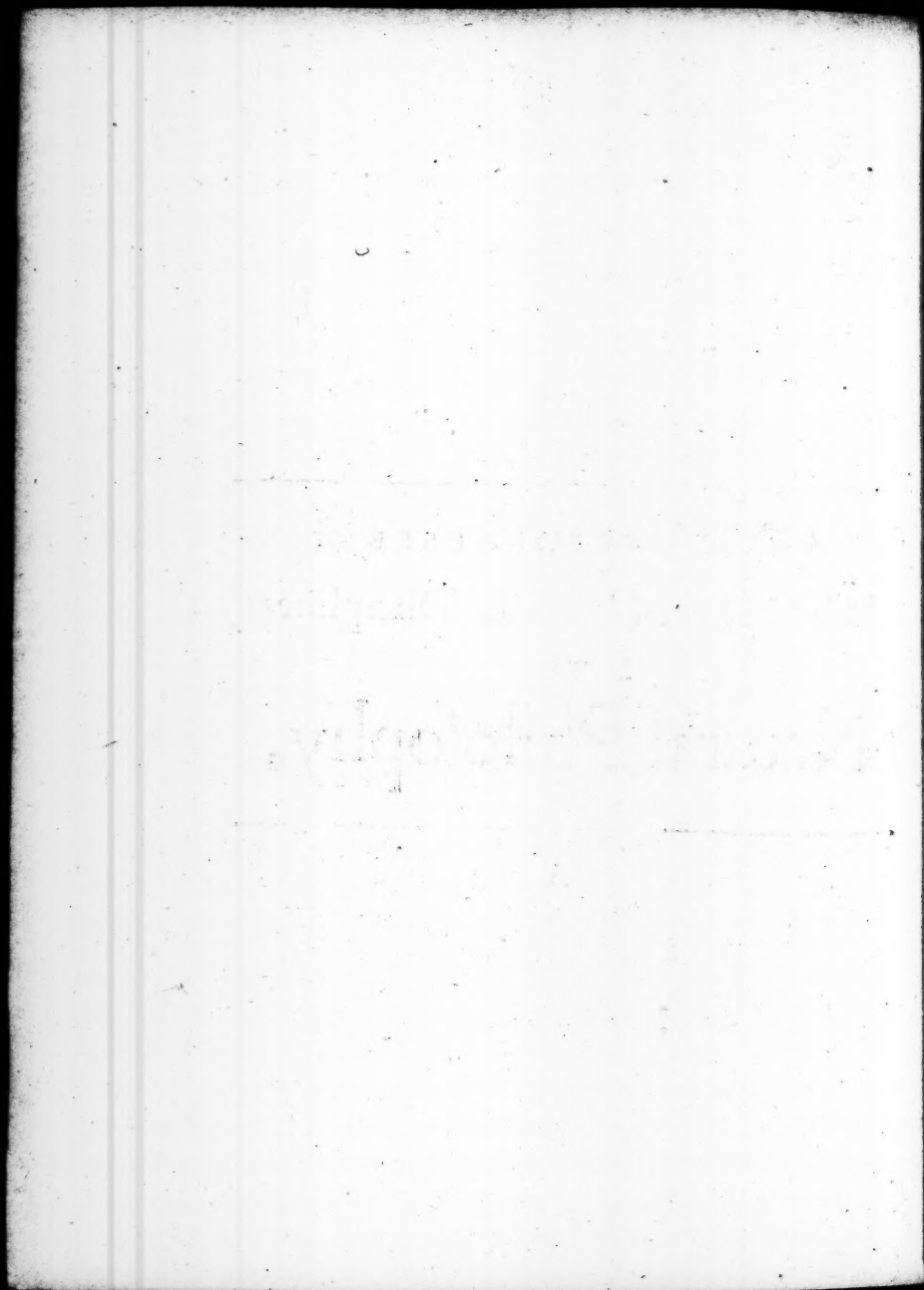
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MR BOYLE'S
{ EXPERIMENTAL }
{ Philosophie. } Vol. II.

Of the V^SE^FU^LN^ES^SE of
MECHANICAL Disciplines
TO
Natural Philosophy.

A





Of the Usefulness of Mechanical Disciplines to
 NATURAL PHILOSOPHY,

SHEWING

That the Power of Man may be much promoted by the Naturalist's skill in Mechanicks.

TO prevent the danger of Stumbling (as they speak) at the Threshold, I shall begin this Discourse with advertising you, that I do not here take the Term *Mechanicks* in that stricter and more proper sense, wherein tis wont to be taken, when tis us'd onely to signifie the Doctrine about the Moving Powers (as the Beam, the Leaver, the Screws, and the Wedg,) and of framing Engines to multiply Force; but I here understand the word *Mechanicks* in a larger sense, for those Disciplines that consist of the Applications of pure Mathematicks to produce or modifie Motion in inferior Bodies: so that in this sense they comprise not onely the vulgar Staticks, but divers other Disciplines, such as the Centrobarricks, Hydraulicks, Pneumaticks, Hydrostaticks, Balisticks, &c. the Etymologie of whose names may inform you about what Subjects they are conversant.

Now that these Arts (if you will allow them that name) may be of great Use to the Experimental Philosopher, and assist him to enlarge the Empire of Man, may be made probable by this general Consideration, That divers of those things which in the former Essay have been evinc'd to make the Mathematicks useful to the Naturalist, may be applied *mutatis mutandis* to the Mechanicks also. Besides that these Disciplines have some Advantages peculiar to themselves. But the truth of what is thus represented in general Terms,

will possibly be better discern'd, and more perswasive, if we descend to some Particulars.

I. First (then) the *Phænomena* afforded us by these Arts, ought to be lookt upon as really belonging to the History of Nature in its full and due extent. And therefore as they fall under the Cognizance of the Naturalist, and challenge his Speculation; so it may well be suppos'd, that being thoroughly understood, they cannot but much contribute to the Advancement of his Knowledge, and consequently of his Power, which we have often observ'd to be grounded upon his Knowledge, and proportionate to it. When (for instance) we see a piece of Wood, duckt under water, emerge again and float, even Vulgar Naturalists think that it belongs to them to consider the reason of this Emerision and Floating, which they endeavour to render from the Positive Levity, which they fancy to be (upon the account of the Air and Fire) inherent in the Wood, though some Woods, that will swim in water, being put into Oyl or high rectified Spirit of Wine may sink.

But I see not why it should not belong to Philosophers to consider and investigate the Reason, why one part of floating Wood appears above the Water, whilst the other keeps beneath it, and why the extant part is equal to the immerf'd, or either greater or lesser than it in such a determinate proportion, and why the same Wood will sink deeper in some waters than in others, (as in a River than in the Sea,) as on the other side some Woods will sink lower than others in the same Water. For if these things be duely examin'd, as they may by the help of Hydrostaticks, not onely the Cause of these and the like *Phænomena* will be discovered; but by the Applications of that Discovery an easie way may be devis'd to measure and estimate the differing strength of severall Salt Springs, and also of divers kinds of Lixiviums, and Brines; to which may be added divers other Practical

Corollaries

Corollaries from the same Discoveries, which I shall hereafter have occasion to particularize.

II. The Mechanical Disciplines help me to devise and judge of such *Hypotheses*, as relate to those Subjects wherein the Notions and Theorems of Mechanicks either ought necessarily to be consider'd, or may usefully be so:

Of this we have Instances, not onely in those Engines that are Artificial, and are lookt upon as purely Mechanical, as the Screw, the Crane, the Ballance, &c. but in many familiar *Phænomena*, in which the Theorems of Mechanicks are not wont to be taken notice of to have an Interest: As in the carrying a Pike or Musket on one's shoulder, in the force of Stroaks with a longer or shorter Sword or other instrument, the taking up and the holding a Pike or Sword at Armes-length, and the power that a Rudder has to steer a Ship; in rowing with Boats, in breaking of Sticks against ones Knee, and in a multitude of other familiar Instances, of which the Naturalist's skill in Mechanicks will enable him to give a far more clear and solid Account, than the Ancient Schoolmen or the Learned'st Physicians that are unacquainted with the Nature and Properties of the Center of Gravity, and the several kinds of Leavers, the Wedge, &c.

III. Nay there are several Doctrines about Physical things, that cannot be well explicated, and some of them not perhaps so much as understood without Mechanicks.

That which emboldens me to propose a thing that seems so Paradoxical is, That there are many *Phænomena* of Nature, whereof though the Physical Causes belong to the Consideration of the Naturalist, and may be render'd by him; yet he cannot rightly & skilfully give them without taking in the Causes *Statical*, *Hydrostatical* &c. (if I may so name them) of those *Phænomena*, i. e. such Instances as depend upon the knowledg of Mechanical Principles and Disciplines.

Of

Of This we have an obvious Example in that familiar Observation, that we partly toucht upon just now about the swimming and sinking of Wood in water. For if it be demanded, why Wood does rather swim upon water then sink to the bottom of it, a School-Philosopher would answer, that Wood abounds with Air, which being an Element very much lighter than Water, keeps it aloft upon the surface of that Liquor. But this Answer will scarce satisfie a Naturalist, vers'd in Hydrostaticks. For not now to Question what is taken for granted, that there is a positive Levity, and that the Air is endow'd with that Quality, Experience shews us, that though when Wood is not heavier than so much Water, as is equal to it in Bulk, it will swim; yet in case it be heavier than so much water it will sink. As we see in divers Woods, and particularly in *Guaicum*, which I therefore the rather name, because Chymists observe that if it be burnt, it leaves far lesse Ashes (and such are suppos'd to contain the Terrestrial and heavy parts) behind it, than many Woods that we know will float in water. And though Stones and Iron be upon the score of their weight, believ'd to be bodies that have little Air in them, yet if the Liquor into which they are put be heavier, bulk for bulk, than they, they will not sink but float, and if forcibly deprest, they will emerge, as you may try when you please, by putting Stones or Iron or the like ponderous Body upon Quick-silver, or melted Lead; so that we need not here consider whether Air be or be not predominant in a propos'd Body, when we would know whether it will or will not sink in an assign'd Liquor.

And though we should admit the Air, whether included in the Pores, or lookt upon as an Elementary Principle to be the Cause of its being lighter than an equal bulk of Liquor, yet the Air would be but the remote Cause of its swimming, its immediate Cause being that the floating Body is lighter

lighter than an equal Bulk of the Liquor, and therefore the same Body without acquiring or loosing Air, may swim in one kind of water, and sink in another. As in the case of heavy Bodies, as Loaden Ships, that having prosperously sail'd over the Sea, are recorded to have sunk as soon as they come into Harbour, i. e. into a more fresh water; and an Egge that will sink in common water, will swim in a strong Brine. Nay a Body may (as I and others have tryed) be so pois'd in water, that if the Liquor be a little warmer then when the Body was pois'd in it, the Body will sink, as twill emerge again upon the Refrigeration of it.

And if this general Answer of the Lightnes of the Air will not give so good an account as Hydrostatical principles, why a piece of Wood will float or sink, it will much less give so satisfactory an Account, why differing Woods in the same water, or the same piece of Wood in differing waters, will sink just so far and no farther; whereas by Hydrostatical principles the *Phænomenon* is easie to be accounted for, according to that Theorem of *Archimedes*, *περὶ ὁψευδων*, That Solids lighter than the Liquor they are put into, will sink in it so far, as that as much of the Liquor as is equal in Bulk to the demersed part, be equal in weight to the whole floating Body: whence these Corollaries are deriv'd, That a floating Body has the same proportion in weight to as much Liquor as is equal to it in Bulk, as the immer'd part of the Body has to the whole Body. And likewise, That as much Liquor as is equal in Bulk to the whole Body, has the same proportion in weight to the said Body, as the whole Body has to that part of it self which is beneath the surface of the Liquor. And as these Corollaries determine the Proportion between the immers'd and extant part of the floating Body; so (to shew you that these Theories lead to Practice) they suggest the way of making a small and light Instrument, elsewhere describ'd, to measure by a floating Body the differing Gravities of several Liquors

Liquors in reference to one another, as well as to the Body it self. And upon the same Grounds the Learn'd *Stevinus* shews, That if you know what part of a floating Body is immers'd in a Liquor, whose Specifick Gravity is also known, as it easily may be, you may presently find the weight of the whole Solid Body, let it be never so much too great to be weigh'd in Ballances or Statera's, yea though it were a vast Ship it self; as supposing that that part of such a Vessel, that lies under water should be 100000 Cubick foot, and that a Cubick foot of Water weighs 70^l, (which though it be not the weight we have observ'd a Foot of Water English-measure to amount to, yet that alters not the general Rule,) by multiplying 100000 by 70 the Product will be 700000^l for the weight of the whole Ship, with all that's contain'd in it, as Ballast, Ordinance, &c. or rests or Leans upon it. If I should ask a meer School-Philosopher, why Sucking-Pumps will not raise Water higher than 40 Foot, (though it be commonly presum'd they will raise it to any height,) or why in an inverted Siphon of Glass if you pour Water and Quick-silver in a sufficient Quantity, the Surface of the water in one Leg of the Siphon will not be in a Level with the Surface of the Quick-silver in the other, but 13 or 14 times as high above the bottom of the Siphon: or why, if a piece of Iron, and a piece of Marble or a Flint &c. be equiponderant in the Air, if the Scales be let down into the water, the Metal will appear far heavier than the Stone. If, I say, I should ask a meer Naturalist both these or the like Questions, I doubt I should much more perplex him; than he would satisfie me. And were easie to adde a multitude of Examples, whereof a good Account will scarce be given by a Naturalist that is unacquainted with Mechanicks, and may easily be assign'd by one that is skill'd in them. But referring the Schoolmen to *Aristotle's* Mechanical Questions, to shew them the Necessity and Usefulness of Mechanical Knowledge,

to give the Solution of sundry *Phænomena* that frequently occur, I will onely adde an Example or two to make good the most Paradoxical part of what I was saying; namely, that there are divers *Physico-Mechanical Phænomena*, which are not to be, I say not explicated, but so much as well understood, without the knowledge of Mechanical Disciplines.

There is a considerable Theorem in Hydrostaticks, which is thought to have been first taken notice of by *Mersennus*, and in a late Writer is thus exprest: *Velocitates motus aquæ descendētis & effluentis per Tubos æqualium foraminum, sed in æqualium altitudinum, habent subduplicatam rationem altitudinum.* Of which the Corollary is, That the Tubes are in a duplicate *ration* to that of the velocities of the Water that subsides in, and runs out of them; so that to make one Tube at a Circular Hole of the same Diameter run out in the same time twice as much Water as another, the greater ought to be not onely twice but four times as long as the shorter. And of the same proportion (my Tryals about which I may elsewhere acquaint you with) divers other Practical Applications may be made, which must not be here insisted on.

IV. As I formerly said of the Mathematicks, so I now say of the Mechanicks, that they may assist the Naturalist to multiply Experiments by those Enquiries that they will suggest, and those Inferences and Applications whereto they may lead us.

Of this we have a noble Instance in the great variety of Tryals, which Enquirers, vers'd in Hydrostaticks and other Mechanical Disciplines, have upon the score of their being so Qualified, been either prompted, or at least assisted to make, about the famous Quicksilver-Experiment devis'd by *Toricellius*, about which though so much has been done already, yet almost every year brings forth new *Phænomena*.

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Another

Another Example to our present purpose we may take from the great Number of new Propositions that the Dilligent *Mersennus* has given us in his Balisticks, about the Force and Effects of Bows, and the like Springy Bodies. But a yet more noble Instance is given us by the most Ingenious *Galileo*, who, as we may learn from the already mentioned *French* Writer, that has given us an account of *Galileo's* new Thoughts in that Language, has publish'd so many Propositions (of which he sets down 19 or 20, with the Demonstrations) about the resistance of Bodies to be broken, and the Weights requisite to break them, and the Lengths at which they may be broken by their own Weight, that he has reduc'd them into the Form, and given them the Title of a new Art.

To all which I shall need to adde no more, than that he who knows and considers what a variety of Useful Propositions have been or may be Mechanically deduc'd from the Observation of *Archimedes*, That a Solid Body weighs less in Water than in the Air by the weight of Water equal in Bulk to that Body, will easily dispence with me for not adding any farther Instances on this Occasion.

And the mention of this Hydrostatical Proposition of *Archimedes* falls in the more properly in this place, because it will warrant me to tell you, that divers Mechanical Theorems are not onely fertile in other Theorems, but in useful Applications too, of which I may hereafter have Occasion to give you some Examples, by acquainting you with the Uses I have made of the lately mentioned Proposition of *Archimedes*, and some Corollaries, that partly by others, and partly by us, have been inferr'd from it.

V. Besides the Utilities that may be ascrib'd to the Mechanicks in common with the more Speculative Mathematical Disciplines, they have some (as I formerly intimated) that are more peculiarly their own, since they may be of
great

great Use to the Naturalist in making of such Instruments and Tools, as for many of his Observations, Tryals, and other purposes, he may either absolutely need, or advantageously imploy.

Of this we have an Example in the Mariner's Compass, as tis call'd; which is so necessary to those remote Navigations, whereto Natural Philosophy and Mankind owes so much. For though *Baptista Porta* does, as well as other Authors, ascribe the Invention of the Directive Faculty of the Magnetick Needle to one of his Countrey-men (*Amalphi*, in the Kingdom of *Naples*,) yet he confesses, that for want of the knowledg of making such Sea-Compasses as we now use, this Lucky Inventor was fain to make use of a piece of Wood or Straw, to keep the Needle a float, and then imbue it with a Magnetick vertue; which was a Shift subject to great and manifest inconveniences. And indeed, notwithstanding the knowledg of the Verticity of Magnetical Needles, if by that of the Properties of the Center of Gravity, or some Practices deriv'd thence, some men vers'd in Mechanicks had not devis'd a way so to poise the Needle, that notwithstanding the Rolling and Tossing of the Ship, it will continue Horizontal enough to direct the Pilot; what would become of him in those Storms, when he has most need of a faithful Guide?

Mag. Nat. lib.
7. cap. 32.

By the help of the Centrobarrical Doctrine Mechanicks have been enabled to make those Dipping Needles, whose *Phænomena* are very odde, and though, as far as I have tryd, they yet seem uncertain enough, yet it may very possibly happen, that farther Observations may reduce them to some Theory, whence Practicall Inferences may be deduc'd.

And you will the more easily believe, that the Mechanical Applications of Centrobarrical Notions may be of immediate Use, if we consider, That by virtue of them divers Writers, and others of unsuspected Credit assure us, that they

have made a kind of Lamp so pois'd, that one may role it up and down like a Bowl, without overturning the Vessel that contains the Oyl, or extinguishing the Flame.

From the knowledg that compress'd Air has a Spring, whereby it resists farther Compression, and a slight Contrivance to make Use of this Pneumatical Principle, an Acquaintance of mine made a slight Engine, which afterwards I found mention'd in a printed Book, by which he was a great Gainer, going, when he was well satisfied for his pains and hazard, to the Bottom of the Sea, and by the help of this Engine staying there sometimes for divers Hours, till he had fetcht up valuable things out of sunk Ships, and tyed Cables about their Guns, that they might afterwards be Buoy'd up.

But there might be given so many Examples of Instruments and Tools, that are useful to the Naturalist, and for which yet he ought to thank the Mechanicks, that twere tedious to enumerate them, especially since the Shops of Mathematical Instrument makers and other Tradesmen, may supply you with enough of them, to verifie what this Paragraph would perswade.

VI. I shall conclude the Considerations I design'd for this Essay by this, That as the Knowledg of the Theorems of Mechanicks, and the Practices which have been thence deriv'd, may very much assist the Naturalist to make good Mechanical Contrivances, according to the Exigences of his several Purposes; so one good Mechanical Contrivance may be equivalent to, and may perhaps actually produce, many good Experiments.

The former part of this Proposition will not, I think, require much Proof. For a man must be but a dull Naturalist, that shall know the Properties of the Center of Gravity, of Leavers, Ballances, Screws, Wedges, and other Instruments for increasing Force, and by frequenting the Shops and
Work-houses

Work-houses of Mechanicians, shall have seen variety of Engines and Instruments to compass different things, if he do not from the Survey and Consideration of all these, grow more able by compounding, varying, and otherwise improving them, to devise such Means and Expedients, as he would not else have thought on, to make *some* Trials that he could not make before, and to make *others* more accurately, or more easily, or some way or other better.

And as to the second part of our Proposition, namely, that one good Mechanical Contrivance may be as considerable as many particular Experiments, by enabling the Naturalist to produce either Numerous, or Noble ones, or both, it may be manifested by several Examples.

And I shall begin with so familiar a one, as That afforded by Valves, or Trap-doors. For as slight and obvious as the Invention of them seems, yet not onely we owe to them a great variety of Pumps and Bellows for Oeconomical uses, but they make very considerable parts of several other Engines, and may, as some Trials have inform'd us, be applied about several new Experiments, especially if they be made of Brass, and yet so small, that like some of those I have had made by skilful Workmen, (who, when I first directed them, told me, that they could not be made,) they may be us'd not onely in small Glas pipes, but in Syringes themselves.

By the help of small Valves, and the knowledg of the Spring of compress'd Air, have been made those Wind-Guns, which may be employ'd not onely to weigh the Air, (whose Weight we found them to evince, but not determine,) but to kill Deer, and other Game, without making a great Noise, that would fright away the rest.

If I did not, *Pyrophilus*, foresee, that in the following Essays of this Treatise I shall have occasion to mention some other Instances of the Service that Mathematical and Mechanical

nical Disciplines may do the Naturalist, I should here add divers particulars, which I had rather you should, when you meet with them, refer hither, and therefore I shall conclude what I intended now to say about these Disciplines, by two or three short Instances, that relate to what I have already said concerning them.

The *First* is, that twas not my Design to treat of the Utility of the Mathematicks and Mechanicks in an absolute way: For then I must have said much to their Advantage which I have omitted, because it would have too much swell'd these Essays, and not have been pertinent enough to them. And therefore I thought it sufficient for me to touch upon those things, on whose account these Disciplines may be made useful to the Naturalist, by assisting him either to frame Theories, or to make Observations and Experiments, some (at least) of which, directly, or in their Applications, either are already, or are like to prove, Practical and Useful. And it seems to me very probable, that the Notions and Practices of these Disciplines, that have been too much hitherto restrain'd by meer Mathematicians and Mechanicians to the Stars, the Earth, the Water, and some few other conspicuous parts of Nature, may be very well extended by a Philosopher to sundry other Productions, as well of Nature, as of Art. As *Archimedes* deduc'd Hydrostaticks from the Application he made of vulgar Staticks, to Bodies weigh'd in Air and Water, or in Water onely: and the Ingenious *Torricellius*, and others, have of late apply'd the Principles of Hydrostaticks to that ponderous Body (which the Chymists reckon among Metals) Mercury.

My next Advertisement is, that mentioning Mechanical Instances, not so much to acquaint you fully with the things themselves, as to make the Medium's to infer what I would prove, I have taken the Mechanical Propositions that I employ'd, as they are delivered by the Artists themselves, without

out warranting that their Proportions will hold true in Mathematical strictness. For though I have made Tryals myself of several things of this nature, yet having often observ'd how difficult it is to find a Mathematical *preciseness* in Physical and Mechanical things, I think it not amiss to intimate thus much to you, though I may elsewhere have a fitter opportunity to make it out, that so great an exactness is in many cases not necessary to make the Rules that want it, useful in Practice.

The Concluding Intimation I mean to give you, is, That I have not hitherto mention'd a Service, that Mathematicks and Mechanicks may often do the Naturalist, which is not fit to be silently pretermitted, and it is, That by Lineal Schemes, Pictures, and Instruments, they may much assist the Imagination to conceive many things, and thereby the Understanding to judg of them, and deduce new Contrivances from them.

That I do not groundlessly say this, you will grant, if you consider how difficult (not to say impossible) it were to go through with a long Geometrical Demonstration, without the help of a visible Scheme, to assist both the Fancy and the Memory; and how difficult it is to give Beginners an *Idea* of the Grounds of Cosmographie and Geographie, without Material Schemes and Globes, your own very recent Experience, as well as that of others, will, I presume, inform you. As it also may, how useful, not to say how necessary, Pictures, and in some cases, Models, are wont to be, when Engines, Houses, Ships, and other Structures are to be judg'd of, that they may be approv'd, or improv'd: but I shall rather take notice, that not onely Mechanical, Mathematical, and Anatomical things, need Schemes and Pictures, to represent them clearly to our Conceptions; but many things that are look'd upon as more purely Physical, may, in my Opinion, be much illustrated the same way. Of which if

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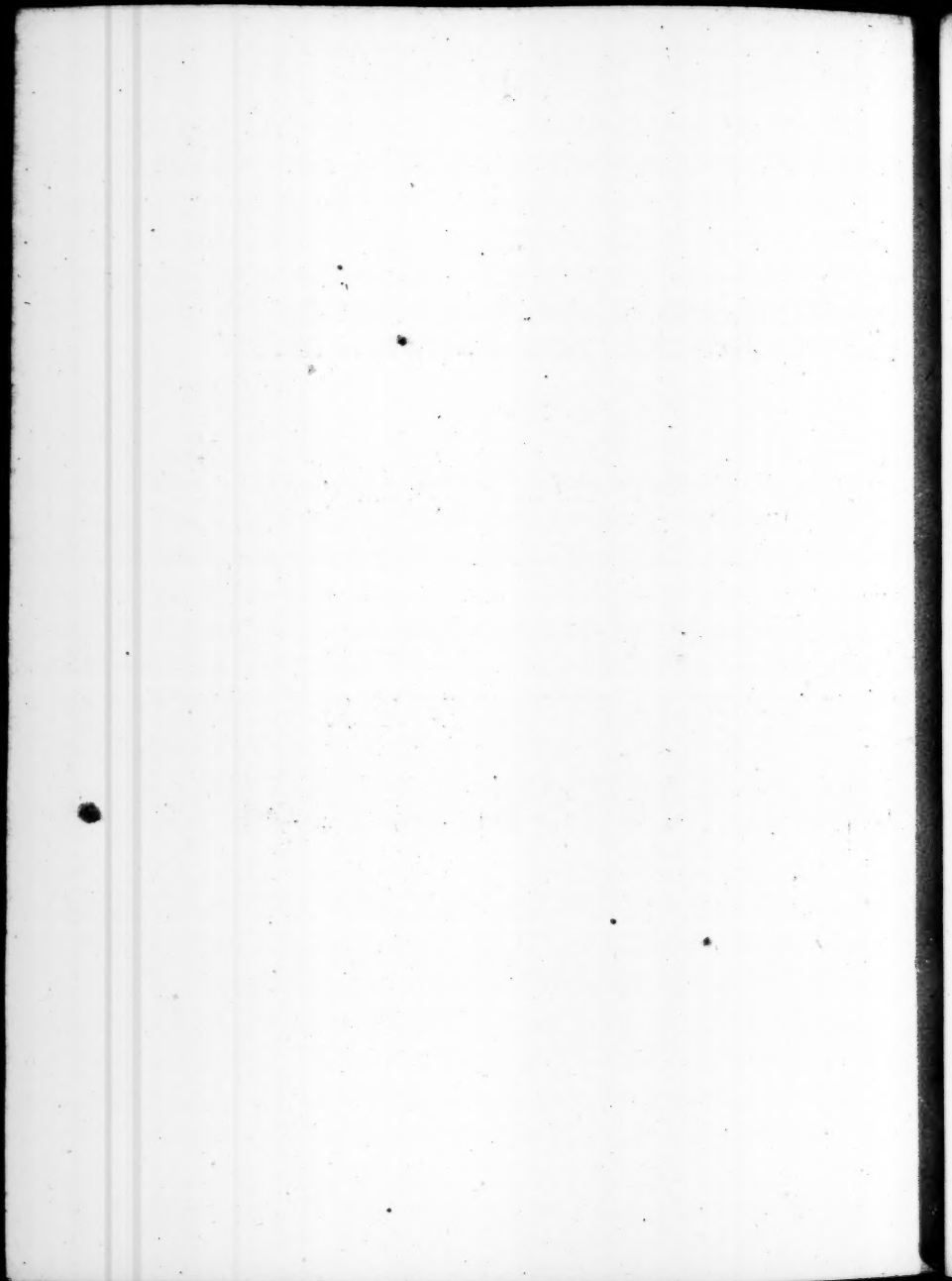
Des Cartes has, as some say, been the Introducer, I think he deserves our Thanks for it. For as *Plato* said, God does always Geometrize; so in many cases it may be as truly said, That Nature does play the Mechanitian, not onely in Animals, but in Plants and their parts, and divers other Bodies; in the Explication of which Curious, and oftentimes invisible Contrivances of Her's, Pictures, that represent them well to the Eye, and, if twere needfull, in Dimensions much greater than Natural, may very much further the framing of right *Ideas* of them in the Mind.





That the
GOODS OF MANKIND
may be much encreased
by the **NATURALIST'S**
Insight into *TRADES*.







*That the Goods of Mankind may be much encreased
by the Naturalist's Insight into Trades.*

TO make out what is propos'd in the Title of this Discourse, I shall endeavour to shew two things. The One; That an Insight into Trades may Improve the Naturalist's Knowledge. And the Other, That the Naturalist, as well by the skill thus obtain'd, as by the other parts of his knowledge, may be enabled to Improve Trades.

The I. Section.

AND first, it seems to me to be none of the least prejudices, that either the haughtiness and negligence, which most men are naturally prone to, or that wherewith they may have been infected by the Superciliousness and Laziness, too frequent in Schools, have done to the Progress of Natural Philosophy, and the true Interest of Mankind, that Learned and Ingenious Men have been kept such strangers to the Shops and Practises of Tradesmen. For there are divers considerations that perswade me, that an Inspection into these may not a little conduce, both to the Increase of the Naturalist's knowledge, and to the Melioration of those Mechanical Arts.

I. And, I consider in the first place, that the Phænomena afforded by Trades, are (most of them) a Part of the History of Nature, and therefore may both challenge the Naturalist's Curiosity, and add to his knowledge. Nor will it suffice to justify Learned Men in the neglect and contempt of this Part of Natural History, that the Men, from whom

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it must be learn'd, are illiterate Mechanicks, and the things that are exhibited are works of Art and not of Nature. For the First part of the Apologie is indeed Childish, and too unworthy of a Philosopher to be worthy of a solemn Answer. And as for the Later part, I desire, that you would consider what we elsewhere expressly Discourse against the unreasonable difference, that the generality of learned Men have seem'd to fancy betwixt all Natural things and fastitious ones. For besides that many of those Productions, that are call'd Artificiall, do differ from those, that are confessedly Natural, not in Essence, but in Efficients; there are very many things made by Tradesmen, wherein Nature appears manifestly to do the main parts of the Work: as in Maulting, Brewing, Baking, making of Raisons, Currans and other Dried Fruits; as also Hydromel, Vinegar, Lime, &c. and the Tradesman does but bring visible Bodies together after a grosse manner, and then leaves them to act one upon another, according to their respective Natures; As in making of green (or course) Glasse, the Artificer puts together Sand and Ashes, and the colliquation and union is perform'd by the action of the fire upon each Body, and by as natural a way as the same fire, when it resolves wood into Ashes, and Smoak unites Volatile Salt, Oyle, Earth and Flegme into Soot; and scarce any man will think, that when a Pear is grafted upon a white Thorne, the fruit it bears is not a Natural one, though it be produc'd by a Coalition of two Bodies of distant Natures put together by the industry of Man, and would not have been produc'd without the Manual and Artificial Operation of the Gardener.

II. But many of the Phænomena of Trades are not only parts of the History of Nature, but some of them may be reckon'd, among its more noble and usefull Parts. For they shew us Nature in *motion*, and that too when she is (as it were) put out of her Course, by the strength or skill of Man

Man, which I have formerly noted to be the most instructive condition, wherein we can behold her. And as 'tis manifest that these Observations tend directly to Practice, so, if I mistake not, they may afford a great deal of light to divers Theories, especially by affording instances, wherein we see by what means things may be effected by Art, and consequently by Nature that works Mechanically.

III. The Phænomena afforded by Trades are therefore the fitter to be translated into the History of Nature by Philosophers, because they, whose profession 'tis to manage those things, being generally but Shop-keepers, and their servants being for the most part but Apprentices and Boyes, they neither of them know themselves how to describe in writing their own Practices, and record the Accidents they meet with: so that either Learned men must observe and Register these things, or we must, to the no small Prejudice of Philosophy, suffer the History of Nature to want so considerable an Accession, as the Shops and Work-houses of Crafts-men might afford it; which accession would be much the more copious, if the Experiment of Trades were made by a Naturalist, who would doubtless so manage them, as to make them farr more Instructive and better fitted for the designe of a Natural History, than the same Experiment would be, if they were related but by an illiterate Tradesman, though never so honest.

And, *Pyrophilus*, to invite you, as you designe a further Progress in Natural Philosophy, to disdain as little as I do, to converse with Tradesmen in their Work-houses and Shops; give me leave to tell you, that as he deserves not the knowledge of Nature, that scornes to converse even with mean Persons, that have the opportunity to be very conversant with Her; so oftentimes from those, that have neither fine Language nor fine cloaths to amuse him with, the Naturalist may obtain informations, that may be very usefull

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usefull to his design, and that upon several scores.

For first, Tradesmen are usually more diligent about the particular things they handle, than other Experimenters are wont to be; because these, if they want diligence, loose nothing, but what that very want of it keeps them from taking notice of, or at most the satisfaction of an unnecessary curiosity; whereas Tradesmen have another ghesse concern in the management of what they imploy themselves about, for their livelyhood depends upon it. And *as*, if they be careless, others more diligent will get away their Customers; *so*, if they do any thing extraordinarily well, the chiefeft and for some time, the whole Benefit will accrew to themselves, and by improving their Profession they better their Income.

Secondly, As it is Proverbially said, that Necessity is the mother of Inventions, so Experience daily shews, that the want of a Subsistence, or of Tools and Accommodations, makes Crafts-men very Industrious and inventive, and puts them upon imploying such things to serve their present turnes, as nothing but necessity would have made even a knowing man to have thought on. By which means, they discover new uses and Applications of things, and consequently new Attributes of them; which are not wont to be taken notice of by others, and some of which, I confess, I have not look'd upon without wonder.

Thirdly, I have severall times observ'd Trades deal with things unknown to Classical writers, and unus'd, save in their Shops. And these are not only factitious, but divers of them Natural; as Manganese (by some call'd Magnesca;) & Zafra (if at least it be what many repute it) Emery, Tripoli, &c. and of both sorts there are some, that are exceeding usefull; as of those formerly mention'd, the two first are to Glasse-men and Porters; and the two Later to a number of other Trades-men; and as among Artificial Concretes,

Concretes, Soaders are of necessary use to Gold-smiths, Lock-smiths, Copper-smiths, Brasiers, Pewterers, Tin-men, Glasi-ers, &c. Amels to Gold-smiths, Glasi-men, &c. Lakes of several sorts to Painters, Heraulds, &c. and Putty to Amel founders, Potters, Stone-cutters, Gold-smiths, Glasi-grinders, and divers other Professions. I shall adde, that ev'n of those natural things, of which some mention is made in famous Books, one may learn many things in Shops, not to be met with there, both as to the differing kinds of things, and as to the marks of their goodness, and as to other Particulars conducive to the knowledge of those subjects. And I freely confels to you, *Pyrophilus*, that I learn'd more of the Kinds, Distinctions, Properties, and consequently of the Nature of Stones, by conversing with two or three Masons, and Stone-cutters, than ever I did from *Pliny* or *Aristotle*, and his Commentators.

Fourthly, You shall often find, that Trades-men, being unacquainted with Books, & with the Theories & Opinions of the Schools, examine the Goodness & other Qualities of the things they deal with, by Mechanical waies, which their own sagacity or casual Experiments made them light upon. And though these, having litle or no affinity with those that a Book-man would have taught them, will appear to him extravagant; yet being such, as, if they really serve the Crafts-man's turn, must be true and useful, their being extravagant will but make them the more new and Instru-ctive, and consequently the more fit to be admitted into the History of Nature.

Fifthly, The Observations that Trades-men can supply us with, though they are not probably at any one time so accurately made by them, as they would be by a Learned man; yet that defect is recompensed by their being more frequently repeated, and more assiduously made, than most of the Experiments wherewith men of Letters have furnished

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furnished Natural History: so that those Circumstances, which are not heeded by the Artificer at one time, may obtrude upon his observation at another, and by reiterating the same Processes so often, it can scarce be doubted, but that divers Phænomena will offer themselves, even to an unattentive Eye; that would not have been all of them taken notice of by a more heedful Experimenter, that had perform'd the Operation but once or twice. But this will be further confirm'd in the next Paragraph.

Sixthly, There are Tradesmen, that do often observe in the things they deal about, divers Circumstances unobserved by others, both relating to the Nature of the things they manage, and to the Operations performable upon them.

Of the particulars, wherein the Observations of Tradesmen (for the Utility of many of their Practises is not questioned) may help us to investigate the Nature of Bodies, I could name more than my present haste allows me to mention, and I shall, as a Specimen, take a little notice, first, of some of the Remarks they have to distinguish and estimate what they call the *Goodness* and *Badness* of the things they deal with; and then of some few of their Observations, that depend upon the Influence, that Time and Season have on the Things they handle, and upon the Artificers Operations on them. For (to begin with the first) although they commonly mean by such termes (of *Goodness* and *Badness*) no more, than the fitness, or unfitness of such things to yeild a good price, and in order thereunto for the purposes they are to be employed about in their particular Trades; yet this fitness or unfitness is wont to consist in, or to suppose, Qualities, that may relate to divers other things, and be apply'd to many other purposes. For some of the Tradesmen's Criteria discover to us a variety and a difference of kinds in Bodies of the same Denomina-
tion;

tion; as from the Potters, the Tobacco-pipe-makers, and the Glassmen, we may learn a considerable variety of Clays; and from Stone-cutters and Masons no lesse variety of Stones untak'n notice of by Classick Authors. So from Carpenters, Joyners, and Turners we may learn, that some woods, as Oake, are fit to endure both wet and dry weather; others will endure well within doores, but not expos'd to the weather; others will hold out well above ground, but not under water; and others on the contrary will last better under water, than in the Aire.

And as the Distinguishing markes we were speaking of may informe us of the differences and kinds of Bodies; so they may likewise on other Accounts give us notice of divers of their Qualities. Thus we find by the Glasse-men and Soape Boylers, that some Ashes, as those of Kely, Bean-stalks &c. do much more abound in Salt, than other some; and yet some of those sorts of Ashes make cleerer, or otherwise better glasse, than the rest do. We may likewise learne of the Maulsters the differing Impressions, that the Barly receives according to the fewel, whether Straw, Wood, Furs, &c. that makes the Fire wherewith 'tis dry'd. And I remember, I have known an-Ingenious Maulster much advantag'd by a way he had of so preparing Mault, as if it had not been dry'd with Wood, (usually the cheapest, but not the best, fewel for that purpose) whereas indeed it was a Secret consisting onely in the choice and seasoning of such a kind of Wood, that ev'n the solid parts of it cleft, burnt almost like straw with a cleer flame, so strangely free from Smoake, that I could not behold it without some wonder.

The other sort of Instructive observations to be learn'd of Tradesmen consists of those, that are made about the Operation, that continuance of time, or change of season and weather, may have upon certain Bodies, and wayes of han-

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dling them. For naturalists, usually contenting themselves to make their Experiments but once or twice, when their leisure best serves, or their occasions most require, have not the same opportunity to discern what influence the temper, which the Aire then is put into, either by the season or the weather or both, may have on the Event of the Tryall; whereas Tradesmen, by long and sometimes unwelcome Experience, are taught such and such things will be best done at such seasons of the year, or in such kind of weather; which if they be not in some cases observ'd, either the thing will not succeed, or the Trades-man will be damnify'd by his Tryal.

Thus we see, that Tanners make choice of that part of the spring, when the Bark abounds with the rising sap, to take it off from the Trees; because at all seasons it will not be so good nor come off so easily. Thus Joyners think not Wains-coat sufficiently season'd till it be so many years old. And in several Countrys, Butchers observe, that though a young Bullock may be very good meat, if spent soon after 'tis kill'd; yet if powder'd, to be long kept, before the beast be 4 or 5 year old, the salt will too much fret it, and make it little worth. And I look upon it as one of the Advantages the Naturalist may derive from Trades-mens Observations; That the same things being successively dealt with by the Father and the Son, the Master and the Apprentice, they sometimes make farre more long winded Observations, than the Philosopher has opportunity to do. As, for instance, those that make Mortars of *Lignum vita*, and will make them good, will keep it in the house 20 years, or perhaps more, to season (as they call it) before they will Employ it. And Experienc'd Masons tell us (and as farre as I have observ'd truly enough) that as there are some sorts of Lime and Stone, that will decay in few years; so there are others, that will not attaine their full hardnesse in 30 or 40, or a much longer

longer time. Of which I may elsewhere give you some Instances.

To the six foregoing particulars, one more may be added to the same purpose with the rest, and it is; That by frequenting the worke-houses and shops of Crafts-men, a Naturalist may often learn other things, besides the truth and falsity of what they relate, concerning the History of the Arts they make Profession of. For though a Trades-man, being for the most part unlearned and aiming onely at making or performing those Particular things, which when done, are to bring profit, usually overlooke those Phænomena, that make not to his Purpose; yet Nature, (who minds as little his Designe, as he do's those works of Hers, that conduce not to it) is by some Agents and Operations, that he imployes to compass his Ends, engag'd to do severall things that have a connection which those the Artificer Prosecutes, or else doe depend upon them: so that the Naturalist may oftentimes observe in Shops divers considerable Phænomena, that the Trades-man regards not; because they neither further, nor hinder him in his work, and will be look'd upon by him as impertinent to the History of his Profession, in case he should be put upon delivering it. And yet some of these occurring Phænomena being produc'd by nature, when she is as 'twere vex'd by Art, and roughly handled by ways unusual, and sometimes extravagant enough, may discover to a heedful and rational man, divers Luciferos things not to be met with in Books, or probably not so much as dreamt of by the Authors of them. Sundry Examples of this I shall have occasion to disperse in the following ESSAY and other Tracts, that are design'd you in this Second Volume of our present Treatise.

The II. SECTION.

I Will now therefore proceed to shew, that as the Naturalist may (as we have seen) derive much knowledge from an Inspection into Trades; so by virtue of the knowledge thus acquir'd, as well as by that, which he has upon other Accounts, he may be able to contribute to the Improvement of Trades.

This he may do by several wayes, and especially by these Three. The first, by increasing the number of Trades, by the addition of new ones. The second by uniting the Observations and Practises of differing Trades into one Body of Collections. And the third by suggesting improvements in some kind or other of the Particular Trades.

The first of these I shall here lightly passe over, having elsewhere Occasion to discourse of it more fully; only I shall here take notice, that, For the Experimental Philosopher to increase the number of Trades now in use among us, it will not be absolutely necessary, that he should invent new ones, since he may do it by reviving the Trades formerly known to the Antients, but lost to us: such as the making incombustible Cloath of Lapis Amiantus, the Tyrian Purple, the Makeing of Mosaick work, and those many other Inventions which you may find mention'd in *Pancirollus*, and his Learned Commentator *Salmuth*. Of which it were not amiss that a Catalogue were made publick; for such things, having been once actually done by men, are not impossible to be done again, and therefore I see no Reason to despair, that in so Ingenious an Age as this, some, if not most, of them may be retriev'd.

The second Advantage, that Trades may derive from an Inquisitive Naturalist, is; That by this means the severall Observations and different practises of Trades, whose
managers

managers want the Curiosity, the skill, or the Opportunity, to make a general Inspection into Trades, which they would find the more difficult to do, because Crafts-men will often be more shie of one another, and more backward to disclose the mysteries of their art to one, that may make a gain of it (and thereby lessen theirs,) than to a Philosopher, that Inquires to satisfy his Curiosity, or Enable himself to be helpful to them. And certainly, if so much as the known hints, that may be given by the Experiments already dispers'd among men of several Professions were known to any one man, though otherwayes but of common abilities; (as my own Experience has in some measure inform'd me) those united Beams, which scatter'd are scarce considerable, would afford him light enough to better most of the Particular Trades, that are Retainers to Philosophy. And perhaps, it were not amisse, if there were some knowing & Experimental Persons appointed by the publick to take an exact survey of the Trades in use amongst us, & informe themselves particularly of all the Secrets & Practices belonging to them, that thus discerning the Errors and Deficiencies of each, they may rectifie the one, and supply the other, partly by the hints afforded by the analogous Experiments of some other Trades, and partly by their own notions and Tryals.

Thus a few of the more Ingenious French Gardeners have of late usefully apply'd, to the watering of young and tender Plants, that way of filtration, which is us'd by Apothecaries with moistn'd Cotton weeks or Rouls, or else with lists of either Linnen or Woollen Cloath, so order'd, that one end being immers'd in the Liquor to be strain'd, the other may hang over the Brimme, and out of the vessel somewhat lower, than the Bottom (or at least the surface) of the Liquor. For if this Lower end of the List be plac'd over the Root of any seed or tender Plant, it will, by constantly & leisurely dropping on it, water it much more temperately and uniformly,

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formly, than can be done by common watering Pots. And ev'n this way of Irrigation may by a cheap and easy mechanical contrivance be very much improv'd. There is another Practice among Stone Cutters, that cast or mold things with Plaster of Paris, to obtain finer Powders, than Searces are wont to give them, by stirring the Powder well in water, and after it has rested a little while, powring off the upper part of the troubled Liquor into another clean vessel, at the Bottom of which there will in time settle an Impalpable Powder. I will not here tell you what use I make of this in Chymistry, to obtain much finer Powders than are usually to be met with of the same Denomination. And I shall but intimate to you, that by letting the first water stand but so much the longer before you pour off the upper part of it, 'till not only the grosser and heavier, but the lesse fine particles be subsided, you may get a Powder, yet much more subtle, than those Artificers, that imploy the former way, without this Circumstance, are wont to obtain. This, I say, it shall suffice me to have pointed at, because 'tis more proper to take notice, that the way of obtaining subtle Powders by the help of water is useful, not onely to the above mention'd Craftsmen, but likewise to Glassemen, Potters, makers of Telescopes and Microscopes, those that cast metalls in Spand, and other Tradesmen too. Besides that I may hereafter have occasion to tell you, that 'tis of great Use in China for the makers of Porcellain.

But 'tis not only by acquainting Artificers of different Professions, with one anothers practices, that the Naturalist may further Trades, but by making Materials imploy'd by one sort of Crafts-men serviceable to another. That Philosopher, who has survey'd a great number of Trades, and compar'd them together, may do this with advantage, you will easily grant, when I shall have advertis'd you, that without any such assistance as that of a Philosopher, in whom their dis-

tinct

finest knowledge may concenter, and who has skill to enlarge the Applications of them, we may observe that sometimes Trades-men themselves can make use of one anothers Productions. Of which I shall give you a couple of Examples, the one furnish'd me by Lytharge, the other by Aqua Fortis.

The former of these, which is but Lead powderd and almost vitrifyd, by being blown off (or melted into) the Refiners Test, as it serves the Chymist to make his Sugar of Lead (which it has been observ'd to do better, than Minium) and other Saturnine Medicines; so it serves divers Comb-makers to die Hornes (as we have try'd by the mixture of Lytharge, Quicklime, and sharp Vineger. It serves also some Painters and others to accelerate the preparations of their fat-Oyles, as they call them. And some Varnishers to make their Varnishes dry quickly. It likewise serves some Artists to make counterfeit Gemms, and we have try'd, that by melting it with about a third part of pure white Sand, or calcin'd Chrystalls, and then putting in a small quantity of Mineral Concret's, according to the colour intended to be introduc'd, one may make Sapphyres, Emeraulds &c. colour'd like the Naturall ones, though this way makes these productions too ponderous, soft, and dimme, and is far inferiour to another we may elsewhere have occasion to disclose.

Other Mechanicall uses of Lytharge I omit, to come to the second Instance I was mentioning, which is taken from Aqua Fortis. For not only Refiners use it to part Silver from Gold and Copper (whence the *French* call it *Eau de depart*) but divers makers of curious wooden works use it for the discolouring and staining of their woods. Dyers make great use of it about their Colours, and ev'n about Scarlet it self. Other Artificers imploy it to colour Bone or Ivory, steep'd for a convenient space of time therein, having first made it of the colour they desire, by dissolving in it
Copper

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Copper (instead of which I have sometimes us'd Verdigrease) or other Bodys, fit for their present turn; and some too by dissolving in it the fourth part of its weight of Sal Armoniac, turn it into Aqua Regia, and in *that* make a Solution of Gold, wherewith may be stain'd (as we have try'd and taught some Artificers) the Ivory hafts of Knives, and Boxes of the same matter, with a fine kind of purple colour, which yet will not suddenly disclose it self on them. Some Book-binders also imploy Asperitions of Aqua Fortis to stain the Leather, that makes those fine Covers of Books, that, for their resemblance to speckld Marble, are wont to be call'd Marbled. 'Tis also imployd (as themselves have acknowledged to me) by some of the Diamond Cutters, to free the dust of Diamonds from Metalline Powders, as I shall hereafter declare. 'Tis likewise of great (and as they imagine of necessary) use to those that Etch Plates of Copper or of Brasse. To which may be added, that we have caus'd Canes to be stain'd into the likenesse almost of Tortois-shell by a mixture of Aqua Fortis, not too well rectifyd (which is unexpedient in this work) and Oyl of Vitrioll lay'd on at several times and places, upon Canes, held over a large chafing-dish of Coales, that by the heat the staining Liquor may be the better suck'd in by the Canes, which must afterwards have a Glosse giv'n them, by being diligently rub'd with a little soft wax and a dry Cloth. Nor are these all the Uses made of Aqua Fortis, as you will find hereafter by Instances, that I reserve for other places. But I thought fit to mention this Liquor in this place, rather than any of those many factitious Bodys I might have taken notice of, for these *two* particular Reasons. The one, that the uses, hitherto enumerated of this Menstruum, may serve to confirm what I told you in the second Essay, of the great Utility of Menstruums. And the other, That though Aqua Fortis be a Liquor of exceeding common use, and wont to be distilled

skilld by men of several Professions, as Chymists, Refiners, Goldsmith's &c. Yet they have had hitherto so little curiosity to enquire into the Nature of it, or vary the wayes of making it, that not onely the wayes, that a skilful Naturalist might direct for improveing it, have not been taken notice of, but no small oversights may be observ'd to be generally and dayly made about it. And an ingenious Gentleman of my acquaintance, by making some Tryals to improve it, has bin so far successfull in his attempts, that he makes it by great odds better, than that which the Refiners are wont to imploy, or (as farre as my Tryals have informd me) than any I have us'd; and affords it for not much above half the price, that is commonly giv'n for it. Nor have his Experiments this way alone promoted the Refiners Trade, but have also disclos'd to him a way of cleerly recovering most of his Aqua Fortis, after he has us'd it in the separation of Metalls, not only in its former strength, but somewhat encreas'd in Virtue; which you will the more easily think possible, if I tell you, that Aqua Fortis may be made and receiv'd in other Vessels, than those that are usual. As also, that without dreaming of this Chymists way, I have reobtain'd that Menstruum exceeding strong, after haveing imployd it upon certain Mineralls (for from others I know not whether it may be so regain'd.) And lastly, that there are some Bodies, besides Glats and Earth, that are not brittle like these, and yet serve for the second Destillation of Aqua Fortis, though made very strong at the first.

And since I am mentioning of this Liquor, I shall intimate (and onely intimate here) that, by adding to Salt-Peter instead of the usual Additament of three times its weight of Brick, or Clay, or the like, about an 8th or 10th part only of its weight of another substance, we have, ev'n in ordinary Sand Furnaces, obtain'd, though slowly, a Nitrous Spirit, or Aqua Fortis much stronger at the first destillation, than

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that which is wont to be sold by our Refiners, for double or
rectify'd Aqua Fortis.

You, *Pyrophilus*, and divers other *Virtuosi*, have much more opportunity to make an inspection into particular Trades, than my other Study and Occasions will allow me, and yet I have bin more than once able to suggest to eminent Artificers such things, concerning their own Profession, as they try'd and thank'd me for. And therefore I have often wish'd, that some ingenious Friends to Experimental Philosophy would take the paines to enquire into the Mysteries, and other practices of Trades, and give us an account, some of one Trade, and some of another, though the more are handled by the same Person 'twill be *ceteris paribus* the better, not only delivering Historically what is practis'd, but also adding their own Reflections, and any other thing they think fit to propose, towards the melioration of the Professions they write of.

And to give you, for a *specimen* of this (not perhaps the best that I could, but) such an one, as will be sure not to make you despair of out-doing it, I will adde at the close of this ESSAY, what came into my mind, and cost me about an houre to set down about the Trade of those that sell Var-nished wares.

Some *Italian* Writers (who indeed are to be commended for it) have given us accounts of some particular Professions, as beside others, that I have heard of, but could not procure, *Antonio Neri* has written *Dell' Arte Vetraria*, and *Benvvenuto Cellini* of *Sculpture* & the Statuaries Art, and of some other Professions, worthy, with the Art of Glasse-making, to be made English.

And indeed, I would willingly invite both you and other *Virtuosi* of our own Countrey, as well as of others, not to disdain to contribute their Observations to the History of Trades: And if you pitch upon any, you may command my
thoughts

thoughts of the method wherein an account of it may be the moſt conveniently giv'n. For I look upon a good Hiſtory of Trades, as one of the beſt means to give Experimentall Learning both growth and fertility, and like to prove to Natural Philoſophy, what a rich Compoſt is to Trees, which it mightly helps, both to grow faire and ſtrong, and to bear much fruit.

And this I was ſo perſuaded of, that I once deſign'd, if the Publique Calamities of my Country had not hinder'd, to bind ſeveral ingenious Lads Prentices to ſeveral Trades, that I might the better by their means, both have ſuch Obſervations made, as I ſhould direct, and receive the better Hiſtoricall accounts of their Professions, when they ſhould be Maſters of them.

III. But 'tis not only by making the Practices and Productions of ſome Trades ſerviceable to others that the Experimental Philoſopher may be a Benefactor to thoſe Professions. For he may do it by the third of the formerly mention'd way's (which in ſome caſes is coincident with the ſecond) Namely, firſt by ſurveying the Rules and Obſervations already receiv'd, and the Practices already in uſe of each particular Trade; he would improve, and then by taking notice of two things concerning it, *viz.* the Deficiencies and Inconveniencies that blemish it, and the Optratives that may be made about it; that he may alſo in the laſt place propoſe Rational (if not certain) Methods or Expedients to ſupply or remedy the firſt; and either accompliſh the ſecond, or make Approximations to it, as far as 'tis feaſeable, or as his ſkill reaches.

By Deficiencies and Inconveniencies, I do not here mean thoſe things, which are wanting to the abſolute perfection, which a Philoſopher might wiſh to find in the Trade he conſiders; (for theſe belong to the Optratives) but thoſe,

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which are wont to be complained of, and not irremediable; or that are wanting to a more easily obtainable degree of Perfection. I shall not pretend to enumerate these in particular Trades, but only observe in general, that the chiefeft of them seem to be such as these.

First, that the Artificer may be too much confin'd to certain Materialls, some of which may be scarce, or dear, or ill condition'd, in comparison of others, that the Naturalist might propose. As I remember, that being in a place where we could not procure good Vitriol to make Aqua Fortis with, after the manner of our *English* Refiners, by a substitution of burnt Allom for Vitriol, but in a farre lesse proportion, we made Solvents for Silver, as good as theirs, if not much better.

And especially in such cases as these 'tis that the Naturalist may be very much assistant to Trades-men. For there are many things which he, who is acquainted with variety of Bodies, and the accounts on which they work on one another, will either quickly discern to be performable by other Materials, than those that Trades-men confine themselves to, or probably ghesse'd to be performable by other Agents more in the Trades-mens power, and by making Tryals of his Conjectures, 'tis like he will within a few Tryals discover what he seeks. I know an ingenious Person, that upon the general complaint made by Tanners, of the scarcity and dearness of the Bark of Oak, found a way to prepare Leather without *that* or any other Bark, as well, if not much better, than 'tis wont to be done the ordinary way, at least as far as I, and divers other more skilful than I, could ghesse by some variety of it, which he shew'd me. And this variety of Materialls, which may be suggested by the Naturalist, is therefore the more considerable, because that though the suggested Materialls be dearer, than that in common use, yet it may be so much better condition'd in other regards,

as to be preferable to it. And though Diamond Dust be very many times dearer, than the Powder of Emry, yet I sometimes cause work to be done for me in a Shop, where to cut some Gemms, and ev'n Loadstones themselves, the Crafts-men I made use of did by my encouragement imploy the pretious Powder of Diamonds, instead of that of Emry, because the former makes so great a dispatch, and obliges them so much the seldomer, to change their Tools they apply it with, as makes an advantagious amends for the deerness. And so, though common Spelter-soder be much cheaper, than that which is made with Silver instead of Spelter, yet in divers cases, this last is preferable even by Artificers themselves. For tryall informs us, that this will run with so moderate a heat, as often needs not endanger the melting of thin and delicate Peeces of work, that are to be soder'd; and if this Silver soder be so well made, as some I can shew, you may with it Soder ev'n upon Soder it self made the ordinary way, with Brasse and Spelter, and so fill up those little hoales or! Cranys that may have bin left or made in the first Sodering, and are not safely to be mended, but by a Soder more easily fusible, than the first.

Secondly, that the Trades-man may be confin'd to certain way's of working, when perhaps it would be much more advantagious to him, if he had others propos'd him by the Experimental Philosopher, who may perhaps discern, that what is Mechanically done by the Artificer, may be better done Physically, and on the contrary. Whereas Goldsmiths, first directed probably by some Chymist, by boyling Silver Spurr, Hilt, &c. of curious Workmanship in Salt, Allome, and Argol, give it that whitenesse and cleanness, which it would scarcely be securely brought to by brushing, or Pumice-stone, or Putty. And the like Cleanness, Experience has inform'd us, that old sullyed pieces of good Gold may be brought to in a trice, by the help

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of warm Aqua Fortis. And as there are divers other things (some of which you will find mentioned in a following ESSAY) that, though wont to be done Mechanically, may be done better by Physical means; so of those things, that ought to be done Mechanically, many things that are wont to be done by the labour of the Hand, may with far more ease and Expedition (the quantity considered) be performed by Engines; by which, if they be skilfully devised, our Observations make us bold to think, That many more of those, that are wont to require a laborious or skilfull Application of the hands, may be effected, than either Shopmen or Book-men seem to have imagined. For not to mention those severall Instruments on which I have *ex tempore* played divers Tunes, that I had never learned, when we see that Timber is sawd by Wind-mills and Files cut by slight Instruments; and even Silk-stockings woven by an Engine, besides divers other Artificial Inventions left not nam'd, because they cannot intelligibly be so in few words, we may be tempted to ask, what handy work it is, that Mechanicall contrivances may not enable men to performe by Engines.

Thirdly, there may be deficiencies also in this, That what the Artificer undertakes, is either long in doing (as in the ordinary way of Tanning, Brickmaking, seasoning Wood &c.) or takes up more paines, or requires a greater Apparatus of Instruments, or else is some other way more chargeable, or troublesome, or laborious to be effected, than it needs be. And these kinds of Deficiencies may in very many cases be supplyd by the Experimental Philosopher. As I know an Inquisitive Person, that has, upon a solemn Tryall, tanned as well as the Masters of the Profession, in far lesse time, (and if I much forget not, in lesse by above half) than they; so in some places they have a quick way of seasoning some kinds of Wood, for the use of Sea-Timber,

ber, by baking it in Ovens, (which way I have alſo known uſed here in *England* to ſeaſon ſome ſorts of Wood for other uſes in a few Howres) ſo whereas our Grinders of Dioptrical Glaſſes have hitherto beleived, that they muſt make uſe of Venice Glaſs, which is very deer and oftentimes very ſcarce to be come by, ſome *Virtuoſi*, conſidering, that the great cleerneſſe of an Object Glaſs is rather an Inconvenience, than a very deſirable Qualification, have newly taught ſome of the Artificers to imploy that courſer and cheaper ſort of Glaſſe, they call Green-Glaſſe, which is made here in *England*, inſtead of the other, which now begins to be thought by the ſkilful (with whom my Obſervations diſagree not) to be inferior to it. And ſeveral Dyers imploy our Woad, which is not far fetched and much cheaper, inſtead of the Eſtern Indigo for Dying of ſome, (if not all) ſorts of Blews, and thoſe other colours, which that Grand Tincture prepares the Cloath to receive.

Fourthly, another ſort of Deficiencies or Inconveniencies may be the want of Durableneſſe, either, as to the very being of the thing produc'd by the Artificer, or, as to the Beauty or the goodneſſe of it.

Of the former ſort may be (not to mention the Decay and ſowring of Cyder, Perry, &c.) the Cracking of Glaſſe of its own accord, and particularly that, which is complained of by divers, who deale in Telescopes, That the Object Glaſſes, which are wont to be made, as I was ſaying, of fine Venice Glaſſe, will ſometimes, (eſpecially in the Winter) flaw of themſelves, and ſo grow uſeleſs, to prevent which, ſome, that are very curious, carry them in their pockets.

Of the latter ſort, is the fading of the Bowdie and of Water Colours in Limning, and the Ruſt of ſhining Arms, and other poliſhed Sreel. Divers of theſe Inconveniencies alſo the Naturaliſt may obviate or remedy; As ſome of the *Virtuoſi* above mentioned, by teaching the Glaſs-Grinders to
make

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make the Object Glasses of their Telescopes of Green-Glasse, have taught them a way to make them durable in spite of the vicissitudes of weather. And I have had pieces of Artificiall Chrystall, whereof some, though in no long time, crackd in so many places, that they changed their transparency for whitenesse; yet another, though much larger, did, as I conjectured it would, hold sound during some Winters, nor was ever broken, but by Accident: and I remember, I told the Arcificer in whose Furnace, the Chrystal, that lasted not, had bin made, that I took, as I do still, the reason of the difference to be, that the durable Chrystal had but a due, and the other an over great proportion of fixt Salt. The reasons of which conjecture I shall have occasion to give you in another place.

And as to the Scarlet Dye (whereof I lately made mention) that it may be much advanc'd, as to point of fixtnesse and lastingnesse, beyond the common Bowdye, I was persuaded by an honest merchant of *Amsterdam*, who had got a great Estate by colouring of Cloth, and was particularly curious about the Scarlet dye. For he presented me with a piece of Scarlet (of which he said he could make enough at a reasonable rate, wherein he almost defy'd me to find either any part undy'd, or to stain it with Viniger, Lixivium and other Liquors, that he nam'd, and indeed by cutting it I found, that though it were a thick peece of Cloth, the middle of it was not (as is usuall in Scarlets) white or pale, but it was dy'd quite thorough; and though of Scarlet I shall elsewhere have occasion to speak farther, yet I ther rather mention it in this place; because it affords me a notable instance, that Trades may be considerably improv'd by those, that do not profess them. For the most famous *Cornelius Drebel*, who was the Inventor of the true Scarlet dye, was a Mechanicien, and a Chymist, not a Dyer; and as an ingenious man, that marry'd his Daughter, related to me,

me, was so far from having bin vers'd in that Profession, when some Merchants put him upon the Advancement of a certain way of dying a fine red, or rather Crimson, that had bin a while before casually lighted on in *Holland*, and prov'd very gainful to the Finders, that he did not know so much as the common way of Dying the ordinary Reds, though the Merchants having once taught him that, by the help of a sagacious Conjecture (to be told you in one of the following Essays) he soon invented the true skarlet dye, which has since bin so much esteemed.

It now remaines, that I mention in a few words the Optatives, that may be propos'd by the Naturalist about the particular Trades he would improve. By which name of Optatives, I mean all those Perfections, that being desirable, are rather very difficult, than absolutely impossible, to be obtain'd. Of which Optatives, there may sometimes belong several to one Craft or Profession.

Of this sort in the Black-smiths Profession may be the making Iron to be fusible, with a gentle heat (as the flame of a Candle) and yet hard enough for many ordinary uses. In the Glasse-mens Trade, and the Looking-Glasse-makers, may be the making of Glasse malleable or flexible. In the Clock-makers Trade, the making the newly devis'd Pendulum Clocks, useful in Coaches, Boates, Ships, and in other cases where they are put into irregular motions.

In the Brasier and Copper-smiths Trade, the making of malleable soder. In the Shipwrights Art, the making of Boats and other Vessels to go under water. In the Diver's Profession some small and manageable Instruments to procure constantly, at the bottome of the Sea, fresh aire not only for Respiration, as long as one pleases, but also for the burning of Lights.

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In the Say-Masters Trade, the quick melting down of Oares & cupelling of them, or at least of Metalls, in a trice without Bellowes or Furnace.

In the Carvers & Joyners Trade, the way of giving a shape to wood in Molds, as we do to Plaister of Paris and burnt Alabaſter.

I know, *Pyrophilus*, that ſuch Optatives may be thought but a civill name for Chymerical Projects; but I ſhall hereafter more fully declare to you, why I think it not altogether unuſeful, that ſuch Optatives ſhould be propos'd, provided, as I hinted above, that they be very difficult, & not impoſſible: That is, that they be ſuch, as are not repugnant to the nature of the things, nor the general Principles of Reaſon and Philoſophie, and ſeem no otherwiſe to be Chymically or Mechanically impoſſible, than becauſe we want Tooles or other Inſtruments and wayes to perform ſome things neceſſary to the compaſſing of the propos'd End, or to remove ſome difficulties, or remedy ſome Inconveniencies, that are incident to us in the Proſecution of ſuch difficult deſigns.

And let me here tell you, *Pyrophilus*, that this Advantage may be deriv'd from the deviſeing of ſuch Optatives to bold and ſagacious Men, that if they deſpair of attaining to the Perfection they are invited to aime at, they may at leaſt endeavour to reach ſome Approximation to it: Thus unſuſpected Eyewitneſſes have inform'd us, that in ſome Countries, they are wont to ſhoe Horſes without the help of a forge, bringing their Iron to ſuch a temper, that, having a company of Shoes ready made, they can eaſily hammer them cold, ſo as to fit them to the ſize of any Horſes foot, which the heat of the Climate, where this is us'd, makes the greater Conveniency. Nor do I
much

much doubt, but that by various Tempers, Iron may be made very ſoft and afterward harden'd; and the rather, be-
 cauſe, as I elſewhere tell you, we have, without Antimony
 or Sulphur, melted it in a Crucible, ſo as to pour it out
 like Lead, and yet afterwards it grew harder, than it was at
 firſt. So that, flexible Looking Glaſſes may be made with
 the help of *selenitis*, you will elſewhere be ſhewn: As alſo
 to foliate with eaſe all kinds of hollow Glaſſes, and ſo turn
 them into ſpecula. That malleable ſoder may be made,
 though we have not yet perform'd it, we do not much de-
 ſpair, and by good Silver Soder ſome Approximation to
 it has bin already made.

Submarine Navigation, at leaſt for a ſhort ſpace, has bin
 ſucceſſefully attempted by the excellent *Cornelius Drebell*,
 as *Merſennus* aſſures us, and as I have bin inform'd, both
 by *Drebell*'s ſon-in-Law, and by other judicious Perſons,
 that have had the account of the Tryals from the very
 men, that went in the Veſſel under water for a good while
 together; who affirm'd, that though there were many in the
 Boat, yet they breath'd very freely, and complain'd not of
 any inconvenience for want of freſh aire. And here alſo
 give me leave to take notice, that this Inventive *Drebell*
 was no profeſs'd ſhipwright, nor ſo much as bred a Sea-
 man.

As for the Optative propos'd for the Divers, I know
 one of them, who by a ſlight Inſtrument that is all under
 water, and has not as others, any Chimney open to the aire
 above the ſurface of the water, has bin able to ſtay divers
 houres at the bottome of the Sea, and remove his Reſpi-
 ratory Engine (if I may ſo call it) with him; and *Merſen-
 nus* aſſures us that a much better way, and in my opinion
 an admirable one, (if the thing be certain) was found out
 and practis'd in his Country, by one *Baricus* who was
 able to ſtay ſix houres under water, by the help of an al-

26 *The Goods of Mankind may be much encreased*

most incredibly scant proportion of air, and ev'n to preserve, at the bottome of the Sea, the flame of a Lamp or Candle, in a Vessel not much bigger, than an ordinary Lanthorne.

As to the Operative propos'd in the Say-masters Trade, I shall in the next Essay teach you a way of Cupelling in small Quantities, without a Furnace, or Coales, or ordinary Cupell, or other Vessell.

And I remember, that by way of Approximation, I made a certain Powder, with which, without a Furnace, I have in a trice melted Lead-Oare (which very often holds Silver) into Metall, and perhaps consum'd some of the baser Metall too.

And lastly, as for the making of Emboss'd-works of Wood in Molds, I am credibly inform'd by a Learned man, that it was actually perform'd lately at the Hague, by the Secretary of a forreign Embassador; but of the way I could not procure the least Hint, though supposing the truth of the Relation, I suspect it was done either by some Menstruum, that much soften'd the Wood, which may afterwards be easily harden'd again, by which way Tortoise-shell may be molded; or else, by reducing the Wood into Powder, and afterwards uniteing the parts into one Body with some very binding and thin kind of Glue, whose superfluous parts may afterwards be pressed out. And I remember, I began (but was accidentally hinder'd to proceed,) a Tryall to make an Approximation to this, by the help of a rare Glue, of which I had the hint, without being much beholding to him for it, from the practise of an Ingenious Tradesman, which as I now prepare it, is made by soaking the finest Ichthyo-Colla (*i.e.* Izeing-Glasse) for 24, or at least for 12 howres in Spirit of Wine (or even common Brandy; for the Menstruum need not be very good, unlesse for some particular uses.) When by this Infusion

tion, the Liquor has open'd and soften'd the Body (which will much swell) both the Ingredients are very gently to be boyld together (and kept stirring that the Ichthyo-Colla burn not, till all be reduc'd to a Liquor, save perhaps some strings, that are not perchance very dissoluble) when tis boyld enough, a drop, sufferd to cool, will soon turn to a very firm Gelly, and whilst tis hot it should be strained thorough a piece of clean Linnen into a Glasse or other Vessel, that may be kept well stop't, a gentle heat suffices to melt this glue into a transparent Liquor with little or no Colour, and yet this fine thin Glue holds so strongly, and binds so very fast, that having sometimes taken two ordinary square Trenchers (for the round ones are wont to be too thick) and layd the one a pretty way over the other, a little of this Liquor put between them, and suffer'd to dry of it self, united the Trenchers so fast, that when force was imployed to break them, it did it else where, not where they were joynd together. So that it seems, the Gluten, that fasten'd the Trenchers together, was stronger, than that, which joynd the parts of the same Trencher to one another. The other uses of this Gelly (which by reason of the Spirit of Wine, will not easily corrupt like other Gellys) belong not to this place. Only I shall adde to our present purpose, that having taken some common Sawdust, and after having imbib'd it with melted glue, strained out slightly what was superfluous, through a piece of linnen, and shaped the rest with my hand into a Ball, this negligent Trial (which was only made to see whether a more accurate might be hopefull) made the Ball, after it had been leasurly dried, so hard, that being thrown several times against the floor, it rebounded up without breaking; but as I was saying, an Accident hindered me from prosecuting the Experiment, which therefore I recommend to you.

28 *The Goods of Mankind may be much encreased*

I will not now stay to tell you, *Pyrophilus*, how it may assist you toward the making such Approximations, as we have bin speaking of a little above. To take each of the difficulties, you would surmount into the several parts it may be conceived to consist of, and make an Enumeration of the possible wayes of mastering each of these, according to some Methods, that might be proposed; because to discourse of this subject would take up too much of the time allotted to the following Essays, and therefore I shall conclude *this* by observing to you, that as you are, I hope, satisfied, that Experimental Philosophy may not only itself be advanced by an Inspection into Trades, but may advance them too; so the happy Influence it may have on them is none of the least wayes, by which the Naturalist may make it useful to promote the Empire of Man. For that the due Management of divers Trades is manifestly of concern to the Publick, may appear by those many of our English Statute Laws yet in force, for the regulating of the Trades of Tanners, Brick-burners, and divers other Mechanical Professions, in which the Lawgivers have not scorn'd to descend to set down very particular Rules and Instructions.



Of doing by
PHYSICAL KNOWLEDG

What is wont to require
MANVAL SKILL.

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*Of Doing by Physical Knowledge what is wont
to require Manual Skill.*

O R

*That the Knowledge of peculiar Qualities, or Uses of Physical
things, may enable a Man to perform those things Physical-
ly, that seem to require Tools and Dexterity of Hand, proper
to Artificers.*

THe Particulars to be mention'd in this 8th Essay, might have been rang'd partly under the preceding Discourse, and partly under the XIth Essay, (which will be the last of this Treatise,) whose Titles are comprehensive enough to take in the Instances that make up this present Discourse, which yet I have rather chose to deliver apart, not onely because they seem somewhat differing from the Examples alledg'd in the two mention'd Essays, but chiefly because the Uses that may be made of such Instances, may make them deserve a distinct and peculiar mention. For tis both a notable Argument of the Industry of Mankind, and may prove a great encouragement to it, that the Help of Philosophie may supply the office of Manual Dexterity, Strength, or Art, and a knowing Head may do what is thought not performable, but by a skillful Hand, or an Arm assisted by some Instrument or Engine. And of these Instances (which may be justly look'd upon as so many Trophies of Humane Knowledge, and so many Incitements to Humane Industry) it will be needles to make any Division, and therefore I shall barely set them down as they come into my mind, no other Order being necessary for Particulars that are

brought but as Proofs, and have not a dependency upon one another.

The Assertion, that makes the Title of this Discourse, the King of *Spain* finds true so much to his Advantage, that, if I mistake not, it amounted for a good while to divers millions yearly. For whereas formerly in the Silver Mines of *Potozi* in *Peru*, (accounted the richest in the World) it was wont to be a very tedious, laborious, and consequently chargeable work, to sever the Silver-particles of the Oar from the ignobler parts of it, by many slow and costly, both Manual and Metallurgical Fusions, and other ways of Segregation, much of that labour is now sav'd by *Pero Fernandes de Valesco*, who, as *Acosta* informs us, first made use at *Potozi* of the property of Quick-silver to Amalgamate with the nobler Metals. For now, by accurately grinding the powder'd and sear'd Oar with Quick silver (strain'd through a Cloath,) and Salt, and decocting them for five or six daies, in Pots and Furnaces fitted for the purpose, the greedy Mercury licks up the Silver and Gold (which it sometimes meets with) without meddling with the ignobler parts of the Oar; and being enricht with as much of them as it can imbibe, and diligently wash'd from the adhering *sordes*, the Amalgam is, by Distillation with a strong Fire, freed from the Mercury; which coming over reviv'd into the Receiver, leaves behind it the fixt Metals, (*viz.* Gold, and Silver,) which may be afterwards (if need be) easily reduc'd into Bodies, and parted by the common way. And by a not unlike way some of our Gold-Smiths and Refiners are wont (as themselves inform me) to regain out of the Dust and Sweepings of their Shops, the Filings and other small particles of Gold and Silver, which fall to the ground in their Operations, and in process of time may amount to a considerable value.

To make an Head, exactly representing the Size, Shape,
and

and Lineaments of the face of any living man, seems to require an exquisite skill in the Statuarie's Art; and yet at my desire, and in my presence, that was lately perform'd by a Tradesman, after the following manner. The party, whose Face was to be cast off, was laid flat upon his back, having round about the Edges of his Forehead, his Cheeks, and his Chin, something plac'd to hinder the liquid Plaster from running over on his Hair: then into each of his Nostrils was put a hollow piece of stiff Paper, of about a quarter of a Foot long, and of the figure of a Sugar-loaf, and open at both ends, that the Affusion of the Plaster might not hinder him to take Breath. And of these Pipes, (which were carefully oyl'd over,) the acuminated Extremes rested upon his Nostrils, and the other were supported by one of the Assistant's hands. Then his face being lightly oyl'd over, to hinder the Plaster from sticking to it, with oyl-Olive, and his Eyes being shut, Alabaster newly calcin'd in a Copper-Kettle, till it was as white as before; was temper'd up with fair water to the consistence of Batter, and by Spoonfuls nimbly put all over his Face, till the matter lay every where neer an Inch thick. Almost as soon as it was all laid on, it began to grow sensibly hot, and in about a quarter of an hour hardened into a kind of Lapideous Concretion, which being gently and easily taken off, shew'd us in its Concave Surface the exact Impressions made there by the parts of the Face, and even by the single hairs of the Eye-brows. In this Mould they cast a Head of good Clay, (by working it in,) and on that Head they open the Eyes, which in the Prototype and Mould were shut, and (if need be) heighten the Forehead, and make what other amendments they think fit; and anointing this new face with Oyl, they after the former manner make a second Mould (of two parts, contiguous all along the ridge of the Nose) with calcin'd Alabaster, and in this second Mould (lightly oyl'd on the inside) they cast with the same Matter

Matter the fore part of an Head, more like the Original, than ever I saw made by the most skilful Statuary, and yet with so much ease, that the very first Tryal I made my self to cast a Face thus, succeeded.

To take the Impression of a Leaf, or other flattish part of a Plant, it may seem requisite that a man be a good Painter: and yet I found, that the thing may be perform'd, onely by holding a whole Leaf (or Sprig of Rosemary, &c.) in the Smoak of a piece of common Gum Sandarack, Rozin, Camphire, or some such Body that emits a copious and fuliginous Steam, (for which purpose I have made use of a common Link, when that was most at hand:) for the Leaf being well black'd by these Fumes, and plac'd betwixt the Leafs of a Sheet of white Paper, if you carefully press the Paper upon the Leaf with the Haft of a Knife, or some other smooth thing, you may thereby print on the Paper in a few moments the exact Size and Figure (but not Colour) of both sides (but especially the back-side) of the Leaf, with the very Ramifications of the Fibres that are disseminated through it. And this may be perform'd, though not so lively, by blacking the Plant, whose picture is required, with the fumes of a Candle or Taper, (especially if it be of Wax) in stead of those of the aforementioned Resinous Concretes, and afterwards proceeding as in the former Experiment: which sometimes may be of good use to you, when you turn Botanist, and in your Travels meet with Plants whose pictures you think worth having, but have not time or conveniency to Draw them.

Another Instance, of the same import with the foregoing ones, may be afforded us by the Art of Etching, whereby Copper and Silver-plates may be enrich'd with Figures, which may seem to have been made by the Tool of some excellent Graver; and yet those Engravings do not require the presumed Manual skill, and are made without such Tools, by having a *peculiar sort of Varnish* (for on the goodness of

that, depends much of the success of the Operation) on the Plates, and drawing on it the Figures to be engrav'd. For all those Lines, where the Plate is freed from the Varnish, by skilfully temper'd *Aqua fortis* (from whose Corrosive violence the remaining Varnish secures the rest of the Plate) may be so curiously wrought on by those few Artists that are skilful in it, that I have very seldom seen lovelier Cuts made by the help of the best temper'd and best handled Gravers, than I have seen made on Plates Etch'd, some by a French, and others by an English, Artificer.

But the knowledge of the Physical properties of things may sometimes enable a man to perform, not onely things to which Mechanical Tools and Manual Dexterity seem to be necessary, but some things also whereto even Mathematical Instruments, and skill in Mathematicks are thought requisite; of which I shall at present propose a Couple of Instances.

In the elsewhere mention'd French Abridgment of *Galileo's* Italian Book, I find a passage very pertinent to our present Design, which agreeing very well with our Observation of that kind, we shall propose it a little more clearly as follows.

*Nonvelles Pen-
sées de Galilée
liv. 1.*

Suppose in a high Church (the Book exemplifies *Nostre dame*) the great Candlestick that hangs from the top of the Church being made to swing, a Philosopher that has observ'd that the Vibrations of a Pendulum, though the Arches it describes be unequal, are in the sense formerly declar'd equitemporaneous; and that, when the Strings, at which such Pendulums hang, are very unequal, their Lengths will have the same proportion, as is between the Squares of the Numbers of their single Vibrations perform'd in the same time: Suppose, I say, that such a Person have a Pendulum with him, whose String (which may be of any length, so it be determinate) is, for Example, a Yard long, it will
not

not be difficult for him, without any Quadrant or Geometrical Instrument, to find out the length of the String that supports the Candlestick, and consequently the height of the Church. For the Candlestick and the short Pendulum being made to swing, beginning both at the same time, let us suppose, that when the Candlestick has made nine Vibrations, the Pendulum of a Yard long has made 54, the Squares of these two Numbers will be 81 and 2916; and because, as we lately said, the length of the Pendulums will have the same proportion with the Squares of the Number of their Vibrations, dividing 2916 by 81, the product will be 36; which shews, that the String, at which the Lamp hangs, is 36 times as long as that of the shorter Pendulum, and consequently a Yard (containing 3 Feet) amounts to (36 Yards or) 108 Feet.

Upon the knowledge of another Physical property of heavy Bodies I remember I have grounded a way to measure vast Heights and Depths without any Geometrical Instruments, and in such cases where such an Instrument cannot be employ'd, by the help of a Pendulum; which, because in this case it must be very short, will require an attentive and expert Observer. For it being known that a Stone, or a piece of Lead, or the like solid weight, falling from a height does so accelerate its Descent, that the differing spaces it has transmitted, at any differing times assign'd, will have betwixt them the same proportion with the Squares of the times, wherein the respective spaces were transmitted; if it be once known by diligent Observation how far a Stone, or such a solid Body, (whose greater or lesser bulk is not here considerable) does fall at the end of the first Second-minute of its motion downwards, it will be easie enough for a Naturalist, vers'd in the Doctrine of Proportions, to collect from the time that the Stone imploies in descending perpendicularly from the top of a high Tower or Steeple, how high
that

that Building is. This way of measuring, provided Attention and Accuracy be not wanting, we found agreeable enough to divers Observations of our own and our Friends; and by this way one may measure the Depth of a Well (to the surface of the Water) how deep soever, though the bottom, as tis usual by reason of the darknes, cannot be seen, which makes the depth unfit to be measur'd by Quadrants, and such like Geometrical Instruments: For if at the same time that you let fall a Stone or other Weight, you also let go a Pendulum that vibrates Quarter-seconds, that is, makes two Excursions and as many Returns in the 60th part of a Minute, and reckon its Vibrations till you hear the noise made by the Stone dashing against the Water in the Bottom of the Well, you may easily enough collect the Depth. For let it be supposed, that it be found by Experience, that a falling Stone, or other like Weight, do in the first Second-Minute of its Descent dispatch (as the diligent *Mersennus* affirms himself to have often found) 12 Feet, (which I understand of French, not having found it hold in English measure,) and let us also suppose the Pendulum to have perfected 6 single Vibrations before the dashing of the Stone against the Water was heard; if we proceed according to the Rule formerly given, we shall find, that if the time, wherein the falling stone transmitted those spaces that are to direct our Calculation, be 1, and 6, the Square of those two Numbers being 1 and 36, the Stone must have fallen at the end of the 6th Second 36 times as far as at the end of the first. And since by Observation (about whose Accurateness we need not be solicitous here, where we design onely the giving an explanatory Example) a falling Stone in the first Second descends 12 foot, we need but multiply 36 by 12, to obtain in the product 432, the perpendicular Depth of the Well to the surface of the Water. And the same number may be collected, and perhaps you will think more easily, by

supposing, as *Galileo's* Experiments seem to prove, that a falling Body accelerates its Descent according to a Progression of odd Numbers, beginning from an Unite; so that if in the first Second-minute, or any other determinate part of time, it falls one space, whatever that be, in the next Second it will fall 3 spaces, and in the third 5 spaces, and so onwards; according to which reckoning, if the falling Body be suppos'd to descend 12 foot, during the first Second it will descend 36 (besides the former 12 in the next Second,) in the third 60, in the fourth 84, in the fifth 108, in the sixth 132, which summ'd up together amount to 432. And by the same way one may measure the Height of divers Precipices how great soever, as far as one can reach downward in a perpendicular Line. And one may also give some guess at the depth of some Voleans, which are not accessible to those that know but the common wayes of Mensuration, or which have burn'd the Ropes, and even melted down the Chains and Weights, by which some Curious persons have attempted to fathom their Depth. 'Tis true, that in Mathematical rigour some Abatement ought to be made, because the Stone strikes the surface of the Water, or the bottom of the Precipice, some little while before the sound, produc'd by that stroak, can arrive at our Ears. But unless the Height or Depth to be measured be very extraordinary, this allowance, for the delay of the Noise, either may be neglected without much Inconvenience, or in probability will scarce exceed a quarter (or at most half) of a Second; since, as has been elsewhere noted, it has been found by Observation, that a Sound in the Air moves above twelve or thirteen hundred foot in one Second. And in what I have here deliver'd concerning the way of measuring Depths and Heights by the falling of a heavy Body, I have been much confirm'd by an Observation I chanc'd to meet with in an Outlandish Book, which I have not now by me to look out the place, where the

the Mathematician that writes it, who seems to have been a diligent Observer, affirms, that he found a Weight let fall from the top of a Church or Steeple (for I remember not which, nor is it material,) so high as to amount to 300 foot, to reach the Ground in about five Seconds; which agrees very well to what we have been delivering. For supposing the Weight to fall 12 foot the first Second, at the end of the fifth Second it must have fallen 25 times as far, (1 and 25 being the Squares of the Numbers of the Seconds of time,) and consequently 300 foot.

To slit (or divide transversly into Flakes or Leaves) so thin a piece of Metal as an old Groat, which seems not to exceed, if it so much as equal, the thickness of a Leaf of white Paper, may be thought, if it be feasible, to require some very subtle dividing Instrument, with an Edg finer than that of a Razor; and yet the way of performing this by Physical means, is but an almost ludicrous Experiment, which (if you know it not already) is easily thus made. Take three Pins, and stick them in the form of a Triangle, at such a distance from each other, that the Groat may rest upon the heads of them: put upon this thin piece of Metal almost as much flower of Brimstone, or at least finely powder'd Sulphur, as will conveniently lie on it; then kindling the Sulphur, let it burn out of it self; which done, take off the Groat, and throwing it hard against the Floor, the upper part, with the adhering remains of the Sulphur, will be parted from the lower: which (lower) if the Coin were not very thin, will retain its former shape. I have observ'd in this Experiment a pretty Circumstance or two, the knowledg of which is very apt to be misemploy'd, and need not here be mention'd: though I would not silently passe by the Experiment it self, because, as ludicrous as you may think it, it may suggest uncommon Speculations to a considering Naturalist, and also intimate a way of preparing Silver, of

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which

which I may elsewhere tell you the practical Use.

He that takes notice of so pretty a variety of Colours and Shapes, as may be discern'd on a skilfully made Sheet of Marble paper, will be apt to conclude, either that the differing Colours were laid on one by one with a Pencil, which would require a great deal of time and pains; or that the Sheet was marbled by being printed off from some Plate, on which the differing Shapes were cut or engraven, and the differing Colours singly plac'd, which would require yet more labour, and a greater *apparatus*; whereas the whole Sheet is painted thus variously and delightfully at once, and in a trice, by the contact of the surface of a Vessel full of Water, on which the Colours (first blended a little by a quick and easie motion of the Artift's hand) are so order'd, as to swim without being confounded. This Artifice hath, as I am inform'd, been deliver'd by the Curious *Kircherus*. But if you have a mind to know the Particulars of it more fully, you may command me to acquaint you with what I have learn'd from Experience, by which the Practice is suppos'd to have been of late improv'd.

If it were propos'd to free weak spirit of Wine or *Aqua vite* from a great part of its Flegm, the Generality of Distillers would think it not to be effected, but by the help of Fire and a Furnace, an Alimbeck, or some other Distillatory Vessels; and yet, without the help of any of all these Instruments, I have sometimes taken pleasure to deflegme Brandy, (as they call weak spirit of Wine of the first Distillation,) onely by putting it into Salt of Tartar. For considering the faculty this Alkalizate Body has to attract (as men commonly speak) or imbibe the Aqueous particles that swim in the Air, and resolve it self with them into that Liquor, that the Chymists call Oyl of Tartar *per Deliquium*, there seem'd sufficient reason to expect, that the same Salt being put very dry into phlegmatick spirit of Wine, would embody with
the

What is wont to require Manual Skill. 11

the phlegmatick parts, with which, if it were not overcharg'd, it would probably keep them separate from the more spirituous Liquor, since such Oyl of Tartar as I have just now mention'd, and dephlegm'd spirit of Wine, will swim upon one another without mixing; and accordingly I have sometimes taken pleasure, by putting a sufficient proportion of dry Salt of Tartar into Brandy, and leaving it there for some time (for the Experiment will, to be compleated, require some while) to make some separation of a great part of the Flegm, which by degrees dissolving the Salt, will reduce again part of it into a Liquor, that will keep its surface distinct from that of its supernatant Spirit, and if confounded therewith by the shaking of the Glass, would speedily part from it, and regain its own station; and if you would have a separation of the phlegm begin to appear quickly, you may compass what you intend, by tying up a convenient quantity of dry Salt of Tartar in a dry rag of Linnen cloth, and immersing it a little while in the Brandy, and then lifting it up a little above the Liquor, for the phlegmatick parts being copiously imbib'd in the Salt, which will be thereby resolv'd into a ponderous Liquor, will in drops (whose descent will be distinguishable enough, if the Glass be held against the Light) fall to the bottom of the spirit of Wine. And lest you should suspect, that this descent comes not from their Weight, but from the force they acquire in falling through the Air, you may keep the Rag immerst beneath the surface of the Liquor, and yet may perceive the Efflux and Subsidence of the Lixivium we have been speaking of.

There are some cases, wherein Bodies, that are to be held very softly, are either so brittle, that 'twould be hard to hold them fast enough without danger of breaking them; or else so small, and so inconveniently shap'd, that 'twould be very difficult to procure Instruments to lay hold on them, and keep

keep them movelesse in the Instrument: and in several such cases the use of Tools, to hold fast such Bodies, may be advantageously supplied by Artificial Cements. As I remember I have known the Glas-grinders, instead of more Mechanical Tools, imploy Pitch, melted and made up with Ashes, very well stirr'd and incorporated with it, into a stiff Past. For this Mixture, being by a fit Heat brought to a convenient Softnes, the Glas to be ground or polish'd is bedded in it, in what posture, and as far as, the Artificer pleaseth; and by the same Mixture the Glas being fasten'd, at the end of a Stick or some proper Instrument of Wood, the Glas, upon the cooling of the Cement, remains firmly fastned, till the Artificer have done with it what he designd; after which, by softning the Cement with Heat, he can readily take it off again.

And even the Diamond-Cutters, who, to grind those Stones into Shapes, are wont to imploy a very vehement Attrition, make use, for holding their Diamonds, especially when they would polish them, of a Cement, the like to which I remember I have some times made to other purposes: for themselves have confess'd to me, that they made theirs chiefly of Rosin, melted and brought to a stiff Past with fine Brick-dust, to which one of the Eminentest of them for skill adds a proportion of Sealing-wax; (I told him I preferr'd plaister of Paris before Brick-dust, and he told me he did the like.)

And indeed by variety of Cements we may be assisted to make divers Experiments, that we could not otherwise make so well, if at all; for which reason I have been somewhat Curious about making a pretty number of such Mixtures, whose Compositions you may command of me.

There are divers Artificers, especially those that slit and polish Chrystal, Agats, and other hard stones, and cut Seals in Gems, who have need of Powders of Emery, of differing degrees

degrees of fineness, and some of them extremely subtle: to obtain these one would think it necessary to have variety of Searces, and some of them as fine as tis possible. But the skilfullest Artificers judg they can obtain their desire much better by fair Water, than by the best Searces. For having in a Mortar beaten the hard Body of Emery; as long as they think necessary, they put the powder into a Pail or other fir vessel full of Water, and then with a stick, or some such thing, they stir very well all that is at the Bottom, that it may be rais'd and thoroughly mingled with the Liquor; then pouring it out into another vessel, the grossest, and the most ponderous Grains of the dispers'd powder, will first fall to the Bottom, and give a powder lesse gross than that which remain'd in the first Vessel, (which may be again beaten small in the Mortar.) Afterwards they powr the troubled Water of the second vessel into a third, and there suffer the Dust to subside, and then decanting the Liquor, if this Dust be not yet fine enough, they trouble the Water again, and after a little while powr it off either into one vessel, or two, or more successively, according to the exigency of their uses; and then suffering the transvased Water to settle for some Hours (more or fewer,) as the disperfed Dust is more or less light, they decant the Liquor, or suffer it to exhale, and take the remaining powders, of which that which settles slowest will oftentimes be strangely subtle. And by this way, if a man will have patience to pour successively the troubled Liquor into Vessels enough, and give the dispers'd powder a competent time to let fall the lesse light parts, before the upper part of the water be pour'd off into the vessel tis finally to settle in, he may obtain several degrees of powders, less and less grosse, and some so fine, as one would admire how twas made so. And this (*Pyr.*) I the rather mention to you, because tis not onely from Emery; but from divers other Bodies that one may obtain extremely minute, and

and (as they speak) impalpable Powders, of great use in some of the most Curious Trades, and perhaps in Physick too. For I may elsewhere tell you, how I apply this way to Magisteries of Chrystal, and of Gems, and even to *Crocus Martis*; the naming of which last puts me in mind to add, That a Chymist much priz'd for finer *Crocus Martis*, than others of his Profession, and thereby enabled to sell it at an extraordinary rate, confess'd to me, that 'twas to the Artifice I have been commending, that the *Crocus* he sold ow'd all its Advantages.

It has long been, and still is in many places a matter of much trouble and expence, as well of Time as Money, to cut out of Rocks of Alabaster and Marble, great pieces, to be afterwards squar'd or cut into other shapes; but what by the help of divers Tools and Instruments cannot in some Quarries be effected without much time and toyl, is in other places easily and readily perform'd, by making with a fit Instrument a small perforation into the Rock, which may reach a pretty way into the body of it, and have such a thickness of the Rock over it, as is thought convenient to be blown up at one time; for at the farther end of this Perforation (which tends upwards) there is plac'd a convenient quantity of Gunpowder, and then all the rest of the Cavity being fill'd with Stones and Rubbish strongly ramm'd in, (except a little place that is left for a Train,) the Powder by the help of that train being fir'd, and the impetuous flame being hindred from expanding it self downwards, by reason of the newly mention'd Obstacle, concurring with its own tending another way, displays its force against the upper parts of the Rock, which in making its self a passage, it cracks into several parts, most of them not too unweildy to be manageable by the Workmen.

And by this way of blowing up Rocks a little varied and improv'd, some ingenious Acquaintances of ours, imploy'd by

by the Publick to make vast Piles, have lately (as I receiv'd the account of themselves) blown up or scatter'd, with a few barrells of Powder, many hundred, not to say thousand, Tuns of common Rock.]

To give small Glasses the shape that is requisite to fit them to serve for Covers to the Dial-plates of Watches, and for other purposes, to which Artificers sometimes imploy them, one would think it necessary, that they should be ground, or otherwise wrought, with Tools, by a skilful hand, to give the Glasses the Concave, as well as the Convex, figure they ought to have. And yet I have learn'd by tryal, that a flat plate of Glas of a competent thicknes, that has its two surfaces smooth and parallel to each other, being carefully laid upon a deep Ring of Iron, or a shallow and hollow Cylinder of the same Metal, and of the Diameter required, so that the edge of the Glas (which is to be reduc'd to roundnes) may every where rest upon that of the Cylindrical piece of Metal; the heat of the fire, warily and skilfully administred, will so soften this Plate of Glas, that its own weight will so deprese the middle parts, that the Glas will thereby obtain the Figure required. And though such Glasses do not constantly fall just into the desired figure, yet when they are skilfully order'd, they fall into it so often, that I am told, that some Ingenious Artificers have quitted the ordinary way of making Covers for Watches, for that we have been describing; which though not free from Casualties, is yet so much more cheap and easie.

We have in some parts of *England* various kinds of Talk, or *Lapis Specularis*, (several of which I have been Possessor of,) and of some of them there is so great plenty, that one may procure good store for little or no charge: but the reducing of a great Lump of this Talk to fine powder, it must be done the common way, by beating it in Mortars, and searcing it often, will require much time and pains; but,

as I have several times tried, the smaller pieces may, by the help of an actual flame, be quickly reduc'd to a Snow-white *Calx*; so by the Experiment of a sagacious Acquaintance of mine, even great Lumps of it may, almost in a trice, be brought to fine powder, by heating them red hot, and casting them, whilst they are so, into cold water, whereby there will presently be made a Commiution of them into a fine, and as it were mealy *Calx*.

The ground of this Operation is much the same with that, whereby some Chymists granulate Masses of Gold and Silver, when they pour the strongly melted Metal from a competent height into cold water, whereupon there happens a Dissolution of the parts of the Metal, many of which fall to the bottom in little fragments. But the more easily fusible metals, Tin and Lead, may be quickly and better granulated by the Mechanical way, freshly mention'd, as to Talk. I remember I was wont (especially if the Ignition and Extinction were repeated 2 or 3 times) to reduce Chrystal Flints, almost in a trice, to a finessle to be easily brought to a very subtle Powder, proper to make *Amauses* (or counterfeit Gems) of.

The mention I have already made in this Essay, of what may be perform'd by the faculty that burnt Alabaster, made liquid with Water, has to grow hard again, puts me in mind of another Instance, very properly referable to the Subject of this Essay. For one that beholds how curiously Oranges and Lemmons, and other Fruits, are counterfeited in Wax, would imagine, that so lively a representation of them could not be effected, but by a hand, as skilful at least as that of a Painter; since by this Plastick Art, not Oranges, and Lemmons, &c. in general, but this or that particular Orange or Lemmon may be most lively represented; and yet you may learn this Art within one hour or two, the thing being performable easily and quickly: for having the Orange &c. we would

would imitate, we bury it half way in a Coffin of Clay, whose Brim, together with the extant part of the Fruit being oyl'd over, to keep the mixture from sticking, the temper'd Alabaſter (or plaister of Paris) is nimbly laid on to a good thickneſs, and, upon its Concretion, remov'd, whereby you obtain an Half-mould for that part of the Orange; then the formerly latent half of the Fruit being likewise plac'd uppermoſt in the Half-mould, which ſhould have ſome pretty deep Notches cut in the Rim of it, which, with the protuberant part of the Fruit, ought to be oyl'd, the temper'd Mixture is likewise put upon that, and thereby an exact Mould is compleated, at any convenient part of which a Hole being made, to pour in a little temper'd and colour'd Wax, when tis brought by Fuſion to a due Heat, (for every degree of that Quality is not convenient,) ſhaking the Mould nimbly and every way, the Wax comes to be ſo applied to the internal ſurface, that when the Mould is cold, and the parts taken aſunder, you have an Orange of Wax very lively repreſenting the Original.

There are ſome Circumſtances belonging to this eaſie and delightful Art of Moulding and caſting in Wax, (which is pleaſant enough to be praſtic'd even by Ladies) that I purpoſely omit: what has been mentioned being ſufficient to ſhew you as much as is neceſſary for my preſent purpoſe. And I the rather pitcht on this Experiment, becauſe it may afford us another Inſtance, not impertinent to the deſign of this Tract. For one that ſhould ſee how great a Cavity is left within the counterfeit Orange, would think that there were ſome great and rare Artifice requiſite to caſt it thus hollow, and make ſo ſmall a quantity of Wax reach to the counterfeitiſg of ſuch a Fruit; whereas the bare ſhaking of the Mould when the melted Wax is in it, together with the expanſive endeavour of the included Air, applies the Wax to every part of the inſide of the Mould, and thereby turns it

into one great Film, which one would think it very difficult to separate, without injuring it, from the Mould, to which tis applied so close, and indeed it might be so, if Nature did not again assist the Artist, by making the Mixture, when it cools, shrink a little, and thereby part easily from the Mould it stuck to.

But one of the prettiest and the strangest Artifices that belong to this Essay, is that whereby the knowledge of a few unheeded Physical properties of two or three Bodies, may enable a man to perform that, which seems to require, not onely good Tools, and great Dexterity in the Art of Graving, but likewise an exquisite skill in Caligraphie, or the Art of writing fair: for I know a Graver, famous for skill in his Profession, who writes, as I have had good opportunity to observe, but a bad hand; and yet this man with his Tool writes rarely well, and will imitate and emulate the finest Copies of the choicest Writing-masters, so that even *Virtuosi* have much admir'd how a man, with a stiff Iron-Tool upon a rough Copper-plate, can write incomparably fairer than the same person can with a good Pen upon Paper. But to ease you somewhat of your wonder, I shall adde, that though this Artifice be kept for a choice Secret, and though I could not learn a considerable Particular or two, which belong to the Delicacy of it; yet (partly by putting Questions, and partly by some Tryals of my own) I attain'd to the substance of this Mystery, as they call it, which seems to be this.

A Writing-Master, or some other that writes a very fair Hand, is desir'd to write a Copy, or what else is to be engraven, with a peculiar kind of Ink, which differs not in show from common Ink, being fully as black as it. Then they take a very clean and well-smooth'd Copper-plate, which being moderately warm'd, is to be so rubb'd over with a certain white Varnish, or something equivalent (to be mention'd

a little beneath,) that when the Plate grows cold again, it may be thinly and evenly cast over with a kind of Skin or Film (if I may so call it) of Varnish, then lightly moistning the Paper, that it may part with its Ink the more readily, the Written side is to be laid on the prepar'd side of the Plate, and That, together with the Paper, being pass'd through a Roling-Press, enough of the Ink will stick (but in an inverted posture) to the Varnish, whose Whitenes renders the black Letters very conspicuous; so that 'tis easie with a Needle (fitted with a wooden Handle) to draw over the very same Lines and Stroaks through the yielding Varnish upon the Metalline Plate, whence they may, after the Plate is by Heat, or otherwise, freed from the Varnish, be completed with a Graver; and lastly, when the whole Engraving is finish'd up, may be printed off in a Roling-Press like ordinary Cuts. And even without a Roling-Press I have sometimes taken off written Characters, onely by laying the moisten'd Paper very smooth upon the Varnish'd Copper, and rubbing it hard thereon with a Convex piece of Glass, or some such smooth and hard Body, whose pressure makes the Ink stick to the Varnish, *for which I have us'd the purer sort of Virgin wax*, if the Ink be good, and have been laid on plentifully enough by the Pen. (That Ink which I most us'd, I made onely of fine *Franckford Black*, as the Painters that sell it are wont to call it, by grinding it little by little, but very diligently, with Water, till it had attain'd the consistence of a somewhat thick Ink; in which this onely Circumstance is carefully to be observ'd, that no Gum be added, as is usual in other Inks, least that hinder its coming off.)

And here twill not be impertinent to the Argument in hand to adde another Artifice, whereby a printed Cut may be so far taken off, that at least the Out-lines and the principal Stroaks may be ready copied for the Gravers hand, by which way, besides other Uses that may be made of it, Copies

pies of rare and choice Pieces may be procur'd, and the perishing or want of the Originals supplied; if then the Print to be taken off be recent enough, (as it is wont to be, if it exceed not a Year, or perhaps two,) then the Paper needs only be well moisten'd, as if it were to be printed off at a Rolling-Press (with the Ink, proper to which tis suppos'd that the Cut was, as usually Cuts are, printed off:) but if the Picture or Scheme be more ancient, it must be laid all night to soak in water, and then hung in the Air, till it have but such a degree of Moisture as makes it fit for the Rolling-press: The Paper being thus prepar'd, either by bare wetting or by steeping, the printed side is to be laid upon a Copper plate, thinly cas'd over, as was formerly directed, with Virgin-wax; for the Plate and Paper being put into a Rolling-press, the Compression of that will make the moisten'd Ink stick to the pure Wax, which consequently will take the Impression of the Cut, or at least of the Outlines and chief strokes of it.

There is another thing which seems above all these to require the express and immediate Operation of the Hand, and it is a Physical way, if I may so speak, of transcribing a whole page of a Letter, or other Writing, all at once. Whether this can be perform'd cheaply and easily enough for common use, is hereafter to be consider'd. But that abstracting from these Circumstances tis possible to be done, (by an Artificial Application of Physical things) I have been perswaded by some Experience, of which I may in one of the following Papers give you a more particular Account, than I now conveniently can.

In the former part of this Essay, *Pyrophilus*, I have presented you some Instances, wherein Physiological Knowledge may be substituted for Manual Dexterity, Mechanical Tools, and even Mathematical Instruments: but now to shut up this Discourse, I shall subjoin a Relation that will manifest, that
even

even a Mathematician and an Engineer may sometimes performe that by the knowledg of a slight Physical Quality of obvious Bodies, which without that knowledg, all his skill in Mathematical Disciplines, and his vast and Artificial Engines, will not have inabled him to accomplish. For who would think that by a comparatively few Pounds of Water (perhaps the Moisture of the Air in wet Weather might have suffic'd) a massy Body of peradventure some hundred thousand pounds in weight should be rais'd, and yet that this was perform'd at *Constantinople*, is one of the remarkablest things I remember I met in the ingenious account of his Voyage, that is given by the Learned *Busbequius*, Embassador from the King of the Romans to the Turkish Emperour. His words are these. *De Obelisco, cujus supra memini, qui est in Hypodromo, sic Græci commemorant; à basi convulsus multis seculis jacuisse humi: tempore posteriorum Imperatorum repertum Architectum, qui operam suam in eo sua basi restituendo deferret; illumq; postquam de pretio conventum esset, ingentem apparatus organorum ex trochleis & funibus præsertim instituisse, quibus lapidem illum ingentem erexerit, sublimemq; eo erexerit, ut uno tantum digito abeset à dorso Astragolorum quibus imponi debebat; tum indicasse populum spectatorem olem illi & operam tanti apparatus pertisse, magnisq; denuo laboribus & impensis opus instaurandum: at illum minimè diffisum perito à rerum naturalium scientia subsidio iussisse offerri immensam aqua vim, qua multis horis in Machinam illam injecta, funes quibus Obeliscus librabatur, sensim madefactos rigentesq; (ut eorum est natura) se contraxisse, sic ut Obeliscum altius sublatum in Astragalis statuerunt, magna cum admiratione & plausu vulgi.* And for confirmation of this Narrative, it may be added, that the same thing is mention'd by good Authors, as having been practic'd elsewhere; and a like story is allow'd, and somewhere made an Argument of (to another purpose) by that great Master of

Mechanicks Galilæo himself.

To

*Aug. Busbequius
Epist. 1. pag. 69.*

To catch any store of Fish the ordinary way, you know tis customary that even in Rivers, either store of Angles, and some skill in using them, or Nets, or some other Artificial Instruments be made use of; and if it be in the Sea that men are to fish, large Nets or some peculiar Contrivances are employ'd as necessary; and one would not expect from such people as the *Americans*, easier wayes of Fishing than these, and yet these illiterate Barbarians, by having found out (probably by chance) the Physical property of a Wood, make that serve them to catch Fish in great plenty, and with as much ease. For our late English Navigators have observ'd, as their Voyages witness, that in some parts of the West-Indies, the Natives, by impregnating the Water with this Wood, do so stupifie the Fish, that rolling up and down upon the Surface of the water, as if they were fox'd, they are easily taken up in great numbers in their hands: which Relation of our Seamen, I therefore, notwithstanding its strangeness, scruple not to alledge, partly because that though we do not use a simple Drug, much lesse a Wood, for the same purpose, yet our Foxing-stuff (as they call it) which is but a slight Composition, produces Effects not much inferior; and partly because having purposely enquir'd of a Learned Physitian, that came not long since out of a part of *America*, where this practise is in request, he assur'd me, that he saw the *English* themselves use this way of Fishing, onely by tying a Log of this Wood, to which (for what reason I know not) they have given the name of Dogwood, to the Stern of their Boats; so easily does the odd Property of this Wood enable them, that make use of it, to catch Fish.

To take off the Hair is generally suppos'd to require both a Rasor and other Implements, and the Manual skill and Operation of a Barbour, especially if the Hair be grown under the Arm-pits, and in other places, which an inconvenient situation or Figure makes to be of difficult access; and yet by

by the knowledge of a property of that Natural production, formerly mention'd in the VI Essay, under the name of *Rufma*, the Hair may be, without Instruments, taken off from any part of the Body, and that not onely in much shorter time than is requir'd to Shaving, but, as far as the Eye is wont to discern, by the roots, which makes it much longer before the part be again cover'd with hair of the former Dimensions. The way us'd in the East to effect this, the fore-cited *Bellonius* annexes, in stead of which I shall tell you what I try'd with a parcel of it, brought into *England* before I met with his Observations about it. We mixt the fine Powder of it with an equal weight of strong powder'd Quick-lime, (*Bellonius*, probably not without reason, prescribes but half as much Quick-lime,) and having suffer'd them to soak together a short while in a little fair water, we thinly spread the soft Past or Slime, made by the water and Ingredients, upon that part of the Body which we design'd to free from Hair; and having suffer'd this Mixture to stay on about 3 minutes (or 60 part of an Hour,) measur'd by a Minute-watch, (our Author prescribes as long time as is requisite to the boyling of an Egg,) we wip'd it off with a Linnen Cloath dipt in warm water, and found the Hair taken off by the roots, without any inconvenience to the part, that we could discern, though I several times shew'd the Experiment to others, and the Trial of it was more than once made upon my Self.

It may seem scarce possible, without the help of Water, or any Engine made with Springs or Wheels, to measure Time, though but for a little while, as exactly as our best Clepsidra's, Clocks, or Watches are wont to do. And yet (which is now a known, and almost vulgar thing) such an account of Time may be kept by him that has observ'd, that the Vibrations or Diadroms of a Pendulum are made in sensibly equal Spaces of Time, though the Arches continually decrease that are made by the swinging Pendulum, (as you

know they now call a Bullet, or the like weight hanging at the end of a String from a Naile, or other fixt Supporter.) For by so slight a thing, as I have been mentioning, if you watchfully observe and reckon the Returns that the swinging Weight makes towards you in a Minute, or other determinate Space of Time, doubling the Number of those Returns, and adding thereto an Unite, if you left off counting, when the Weight was at the further end of the Arch describ'd by its motion, you may obtain a more accurate Division of Time than by any of the formerly known wayes of measuring it. For if You make your Pendulum of the length of very little (perhaps a Tenth of an Inch) less than ten Inches (or twelve parts of our English Foot,) accounted from the Naile, or other thing whence tis suspended, to the Center of the Pistol-Bullet, (or the like small round Weight;) and, removing this a pretty way from the Perpendicular it naturally rests in, suffer it to fall gently out of your hand, each of its two swinging motions (the one whereby tis carried from you, and the other whereby it returns to you) will be (especially whilst the Arches are of a moderate length) Physically *equitemporaneous*; and these motions will very distinctly enough, to an attentive eye, divide a Minute or sixtieth part of an hour into an hundred and twenty parts, (call'd Half-Seconds,) and will consequently divide an Hour into seven thousand two hundred parts, if not perfectly equal, yet lesse unequal, as to sense, than the Divisions of Time made even by good Watches are wont to be. And therefore this way may be of very great use in making Astronomical and other Observations, that last not long, but require exact measures of Time. And by the help of a Pendulum a skilful Musitian of my Acquaintance, teaches his unpractis'd Scholars to keep time when they sing in his absence. But when we measure Experiments by the Excursions and Returns of a Weight, the best way is to make the Duration of the Pendulums whole motion

NB. The Author has elsewhere shown, that the English Foot differs very little, if at all, from the ancient Roman.

motion (before it come to rest) as long as the place where the Experiment is made will permit, renewing now & then, if need be, the Impulse given to the Weight, when the Arches begin to grow too short; that being increas'd, the Vibrations may be the better reckon'd.

The mention I have been making of the Uses of Pendulums, joyn'd to that I lately made of *Æquivelocity* of Sounds, bring into my mind another Instance pertinent to this part of our Discourse. For tis not impossible by the knowledg of the Velocity of a Sound's motion in the Air, and the *Æquivelocity* (as to sense) of great and small Sounds, to measure without Geometrical Instruments, in some cases the Breadth of a River though exceeding wide, or the distance of the place one stands in, from the top of a high Tower or Hill on the other side of a River, or situated in some inaccessible place, and this in cases where the difference of Stations usual in Geometrical Mensurations is not allowed. The way is evident by what is elsewhere delivered. For it having been found by *Mersennus's* Tryals that Sounds (as well small as great) do move in a Second (as they call the 60th part of a Minute) 230 Fathom, or thirteen hundred and eighty foot; if I see my Correspondent fire a Gun on the other side of the River, or if I see Muskets or other Guns casually fired on some Tower or Bastion, though never so far distant, and never so inaccessible to me, tis easie for me by letting fall a short Pendulum, as soon as I see the flash of light produc'd by the kindled Powder, and by reckoning the Vibrations (made by that short Pendulum, which distinguishes *Seconds* into halves or quarters) that shall happen to be made before the Noise arrive at my Ear, to know how far off the place, where the Gun was discharg'd, is from that I am in. As if a Correspondent, standing over against me on the other side of a River, or some Souldiers being there exercising, I see the flash or smoak of a Musket or other Gun two Se-

conds sooner than I can hear the Report of it, I may conclude the River to be 2760 foot broad; and if a Peece of Ordnance being fir'd upon the Tower of a beseig'd place, the noise arrive at my Ear in $\frac{1}{2}$ a Second, I may collect 690 foot to be the distance betwixt that Gun and my Station. And by this means may that Probleme be perform'd that we elsewhere mention as a thing, which, when nakedly propos'd, may seem impossible. For if I see a Ship at Sea be shooting, whether in earnest, or for Salutation, or for Joy, tis very possible for me to measure, without Geometrical Instruments, how far tis off, though the Ship it self be under sayl. For Vessels that fire Guns, usually firing more than one, whether to offend their Enemies, or to salute their Friends, tis easie to take warning, by the first Gun, to be in readinesse with a short Pendulum against another to be fired, and in this way of measuring (though not in any other yet known) one may take Distances in the darkeſt night. For it matters not whether I see the Ship or place, whose remoteness from me I would know, provided by some Candle or Taper I see my Pendulum before the Flash of the fir'd Gun, which will sufficiently discover its self by its own Light. And (to add That upon the by) I have had sometimes Thoughts, that if the Velocity of Eccho's, which are but reflected Sounds, be so well determin'd as that of direct Sounds, Navigators might sometimes make useful Estimates in dark nights, whether they be neer Coasts, or considerably great Rocks. For though upon discharging a Gun they cannot conclude how neer the Shore they are, because there may be parts of it lesse remote than those that send the Eccho; yet if they follow very quick upon the discharge of the Gun, they have reason to suspect that the Shore, whose approach the Sea-men do so justly fear in the night, is at least as neer as the Vibrations of the Pendulum inform them that the Ecchoing place is.

ESSAY X.

Of Mens
GREAT IGNORANCE
of the Vses of
NATVRAL THINGS.

A

1823

STATE OF NEW YORK

County of ...

JANUARY



ESSAY X.

Of mens great Ignorance of the Uses of Natural things.

OR

That there is scarce any one thing in Nature, whereof the Uses to Humane Life are yet throughly understood.

THis being an entire Proposition, and clear enough of it self, will not need to be Explicated but Evinc'd: And evinc'd somewhat solemnly it will require to be, not onely because tis a Paradox, but such an one as will meet with a peculiar Indisposition to be entertain'd; since Men cannot allow this Paradox to be a Truth, without such a Confession of their Ignorance as must implicitly accuse them of Laziness too. But however I think we may justly enough apply, with a little variation, to our present purpose, that true saying of *Seneca, Multi ad Sapientiam pervenissent, nisi &c.* and affirm, that many had attain'd to a greater knowledg and command of Nature, if they had not presum'd that what is arriv'd at already, is much greater and more considerable than indeed it is; especially in comparison of what is still behind, and yet attainable: and therefore I think it not fit to suppress the Considerations I was about to mention, since the displaying them may perhaps do you and others Service, if they rouse up your Curiosity by shewing how much it has been defective, and it (which they ought to do) they encourage it also, by shewing You how much of Nature undiscover'd there yet remains, to Recompenſe as well as Exercise your Industrie.

But because that of the Particulars, whereby our Paradox may be confirm'd, there are divers that properly belong to the next ensuing Essay, the Proofs that we shall mention in this Discourse, though I hope they will appear sufficient alone, will yet be much strengthened both as to number and weight, if you please to adde to them those Instances to be mentioned in the next Discourse that may be conveniently referr'd to This. In which I shall therefore insist but upon V. general Considerations; In all which I hope You will not forget that I have already taken it for a Supposition, which I doubt not of your granting me, That the Usefulness of the works of Nature to us depends chiefly upon the knowledg we have of their Properties and other Attributes; and consequently, that the more we know of these, the greater Use we are like to be able to make of those Physical things, (and on the contrary.) And therefore that ought to be look'd on as an Use of a Physical thing, even though not immediately practical, that helps us to make Discoveries of things that probably may prove so.

The I. Section.

AND I consider in the first place, *That there are very few of the Works of Nature that have been sufficiently consider'd, and are thoroughly known*, even as to those Qualities and other Attributes of this and that Body (or other Physical thing) which belong properly to it. and are not thought to be so relative to other Bodies. 'Tis not onely in the Terrestrial Globe, but in almost every Body to be met with in it, that there may be a kind of *Terra incognita*, or undetected part, whose Discovery is reserv'd for our further Industry.

This will appear the less improbable, if we consider these two things; whereof the one is, that there are divers ways of investigating the Attributes of Bodies, as Chymical,
Optical,

Optical, Statical, &c. which being Artificial, and requiring Skill; and Industry, and Instruments, there are very few men that have had the Curiosity and Ability to examine them after these several ways: Without which nevertheless, divers other Attributes, some of which probably are capable of useful Applications, are not like to be discover'd. To the Proof of which, if it were needful, a multitude of Passages in these present *Essaies*, as well as in our other Writings, might be easily referr'd.

I shall therefore rather insist a little on the 2^d of the two particulars lately mentioned. For it will easily appear not unlikely, that there should be many things undiscover'd in the other Works of Nature, when there are so even in those obvious and familiar Objects that men are frequently conversant with, and have occasion to take Notice of; nay even in those Noblest of meer Corporeal things, our own Bodies, whose Structure does so much merit our Curiosity, and of which it so highly concerns no less than our Healths and Lives, that we have an Accurate knowledg. How many new Discoveries have been made in the present Age, beyond what the Industry of the Physicians and Philosophers for above 2000 years has been able to take notice of? Witness the Circulation of the Bloud, the *Acellian*, *Pecquetian*, and *Bartholinian* Vessels; to which may be added the *Ductus Pancreaticus*, and to which I doubt not will be added divers other Discoveries, to recompense the Industrie of the Anatomists of this inquisitive Age.

In so familiar Bodies as Eggs and Chicken are, which so many thousand persons do dailey see and handle, and perhaps eat, though many Ages since even *Aristotle* was solicitous about the History of them, concerning which he has deliver'd divers not inconsiderable particulars; yet there has been little within these few years so much undiscover'd, that whilst men were hotly disputing whether the Chick was first form'd

of

of the Yolk or the White, our excellent *Harvey* made it evident (which our own Observations have confirm'd to us) that it is made of neither, nor yet of the Tredle, (as some modern Observers have taught,) but of the *Cicatricula* or Speck that appears on the Coat of the Yolk.

Who would imagine, that in a Body so familiar, and so often treated of by Philosophers, as Snow, Mankind should for so many Ages take no notice of a thing so obvious as the Figure of it frequently is; and yet *Kepler* is by a very learned Writer acknowledg'd to have been the first, that acquainted the World with the Sexangular figure (as tis wont to be call'd) of Snow, in a Discourse by him publisht on that Subject; and though I find mention made of it in *Olaus Magnus*, and have observ'd it so often (but not constantly in the same shape,) especially about the beginning of the season of Snow, that I cannot but admire, men should not have very early heeded so obvious a *Phænomenon*, yet I find not the Discovery of it had been made so much as an Age agoe.

As many Ages as Vinegar has been one of the commonest Liquors in the World, yet that it oftentimes abounds with Shoals of Living Creatures, that move, and in the Microscope look like little Eels, was lookt upon but few Years since as so new a Discovery, that when, as I formerly noted, I first propos'd it here in *England* to divers very Learned Men and *Virtuosi*, as a thing to be seen even without the help of a Magnifying Glass, they took it to be a deception of my Eyes, till their own assur'd them of the contrary.

That the Milky Way, though consisting of innumerable Stars, should for 2000 Years pass for a Meteor, the inconspicuousness of those Stars keeps me from much admiring. And for the same Reason I wonder not, that the men that liv'd before *Galileo*, reckon'd no more than 7 Planets, or suspected not that *Venus* her self is sometimes Horn'd, and has her Full and Wane as the Moon. Though these In-

stances

stances may serve to confirm what I lately told You, That many of the Attributes of Bodies are not like to have been discover'd by those that imploy'd not Artificial Helps. But what may we not expect that Mankind may overlook, when the Sun himself, which is not onely the most conspicuous Body in the World, but that by whose Light we see all the Others, may have vast and dark Bodies (perhaps bigger than *Europe* or *Asia*) frequently enough generated and destroy'd upon him, or about him; and men, without excepting Astronomers, never took notice of it, till of late Years the Excellent *Galileo*, or the industrious Jesuite *Scheiner*, informed the World of them. And though I grant that they discover'd them by the help of Telescopes, (Instruments unknown to the Ancients,) yet if Men had been as watchful, as the Nobleness and Conspicuousness of the Object would make one expect, they might have discover'd some Spots at least without those Helps. For I find by an Italian Letter of *Galileo's*; that some Curious persons of his Acquaintance, after his Discoveries had awaken'd them, descry'd and discover'd some of those Solar Spots with their naked Eyes unassisted by his Tubes.

It may belong to this first Section of our present Essay to take notice; that one Account, on which we may reasonably suppose men to be ignorant of the Uses even of those things wherewith they think themselves well acquainted, may be, that the bare difference of Climates, and of Places, may even in such Bodies as we familiarly converse with, beget such new Relations betwixt them, as may endow them with Qualities, and fit them for Uses we dream not of.

I will not here mention the differing Qualities that Bodies, vulgarly referr'd to the same *species* of Plants, Animals, and other Bodies in almost all Countries, are endow'd with in some Countries; (as that Spiders are not venomous in *Ireland*, and *Irish Wood* in general, if the received Tradition be

be true, has an hostile faculty against venomous Creatures, because the insisting on this Subject would take up too much room in this place, and is reserv'd for another; and therefore He only adde a Couple of Instances, the One to manifest what difference of Climates may do, and the Other to shew the unexpected Influence of difference of Places, though perhaps in the same Climate.

The First of these Examples is afforded us by Water and Ice; for those that live in those warmer Regions where it never freezes, and who have divers of them derided the Relations of what happens in gelid Climates as ridiculous, in probability would never dream, that it could be a familiar use of a Liquor they were so well acquainted with as Water, to be broken or beaten in Mortars like a dry Body, and carried in Carts or Wheel-Barrows from place to place, and kept all the Year in that form, to make other Water intensely cold in the greatest heats of Summer. And even amongst us, those that have not been very inquisitive, can scarce imagine that one of the uses of Water should be to serve for High-Wayes, whereon Armies may march for divers daies together, with all their Carriages and Artillery, and whereon they encamp and fight Battels with as much assurance as on the firm Land; and yet those that have been in *Russia*, and the neighbouring Northern Countries, assure us, that during the Winter when the Rivers are frozen over, they usually take great Journeys on them, and oftentimes rather than in Summers, and choose that rigorous Season, which allows them to march every where without sinking into the Ground, to prosecute their Wars in.

The Second of the forementioned Instances we are supplied with by the Declination of the Magnetick Needle from the true North and South points, and the variation of that Declination. For though the Loadstone were highly admired, as well by Philosophers and Mathematicians,

as the Vulgar; and though since the great and happy use of it to Navigation has been generally known, men have been upon several accounts invited to consider it with a peculiar attention and regard, yet that in some places the Magnetick Needle does not point directly, perhaps not by a great many degrees, at the Pole, as in others it does, is no ancient Observation, since tis ascrib'd to *Sebastian Cabot*; and it appears by the Writings of our famous Countrey-man *Gilbert* Gilbert de Ma. guete lib. 1. c. 1. himself, *That it must be some body that liv'd since he wror, that must have the honour of being allow'd the first Observer of that strange and unexpected *Phenomenon*, *That oftentimes in the self same place, the declination of the Needle towards the East or West, does in process of time considerably alter.* * See the same Gilbert lib. 4. cap. 3. Which Discovery I could confirm by comparing some Observations I have had Opportunity to make, with those recorded by some modern Authors.

And as the same kind of Bodies may have differing Qualities, and consequently Uses in differing places; so they may have, if examin'd or imploy'd at differing times, comprising under that name, together with the 4 Seasons of the Year, those peculiar Seasons or Periods of Time, to which some signal Change of Qualities or state in particular Bodies do belong.

The Mutations, upon the account of Time, which I am here speaking of, are not those that are obvious to every Eye, such as the differing Qualities of Fruit green and ripe, or the Degeneration of Wine into Vinegar, but such as are not vulgarly taken notice of, and require either Skill or Curiosity, or both, in the Observer; and of these a few Instances will suffice for a Taste.

When common Urine either is freshly made, or has not long been kept, the volatile and pungent Salt is so clogg'd with other particles wherewith tis associated, that usually, to obtain it, one must evaporate or distill away near 8 or 9 parts

of 10 of the Liquor, and then at length give a not inconsiderable Heat to force up the Last: but though the Tradesmen that deal in Urine do commonly overlook the difference; yet if the crude Liquor be kept 6 or 7 Weeks, though not near the Fire, the Saline and Noble parts will have so extricated themselves, that a very gentle Heat will make them ascend, and leave behind them that Phlegm that formerly would have preceded them.

That the *Thames* Water, which our Navigators are wont to take with them in long Voyages, after a while, if they sail into hot Climates, stincks very often too offensively to be potable, that, which happens usually to Water which is vulgarly observ'd to putrefie by long standing, will easily persuade us; and yet tis found, that this Water, by being kept long enough in the same Vessels, though it be in the same or even in an hotter Climate, will at length loose its Stinck, and grow potable again; as I have, upon Enquiry purposely made, been assur'd, not onely by the vulgar Tradition, but by two very inquisitive Persons upon their own knowledge: the one having particularly observ'd it, sayling betwixt *Europe* and *Africa*, and the other in a Voyage to, and from *America*. And I the rather mention this, because I am very credibly inform'd, that there are divers other waters, that have this faculty of recovering after Putrefaction, which is suppos'd to be peculiar to the water of the *Thames*.

And, if I much mistake not, one or both of these very Persons nam'd another River to me, with an affirmation of its having the same power of Self-Recovery. And having held some Curiosity to try Experiments, how Pump-water, or the like rough Water, as they call them, that would not bear Soap, may be help'd, an Industrious Person I employ'd assur'd me, That he met with Pump-waters, which after having stood a few dayes, without having any thing done to them, would bear Soap, which before they would not do.

Coriander

Coriander Seeds, being freshly gathered, have been observ'd to have so much Acrimony, that divers of the Ancient Physicians reckon them among Venemous Plants; and in Dispensatories they are usually prescrib'd to be prepar'd with Vinegar, or some other Corrective: whereas the more accurate Observers take notice, that within a competent time after the Seed is gathered, it looses of it self that excessive Acrimony that at first blemish'd it. And the like I find observ'd, by good Apothecaries, of the roots of Aron, which are mitigated by keeping, (and which some noted Physitians of my Acquaintance do little lesse magnifie to me than does *Quercetan* himself.)

[That Vegetables, what *known* way soever they are wont to be laid up, and *order'd*, do not afford, unlesse first reduc'd to Soot, any dry volatile Salt, like that of Animal Substances, I elswhere more particularly declare, and those that have had the Curiosity to try it will confirm; but yet by some Discourse I lately had with a very Ingenious person, and some subsequent Tryals made after a way I devis'd to examine distill'd Liquors, I was satisfied that there are divers Vegetables, and those very commonly growing here in *England*, which being gather'd and laid together at a certain Season, and distill'd also at a certain nick of time, will yeild, in stead of the Vinegar-like and other Liquors wont to be afforded by such Plants distill'd the common way, a volatile Spirit; which in Smell, Taste, and divers operations, as turning Syrup of Violets green, hissing with acid Spirits, &c. resembles the volatile Spirits and Salts of Animal Substances; and, which I doubt not but You will wonder at, this great Change, whose Secret I wish I durst teach You, is effected without the help of any Additament.]

And that You may not think that tis onely in Vegetable & Animal Substances, that are commonly of a more loose or alterable Texture, that the trying things at one time

rather than another may be very considerable , I will add a couple of Instances even in Mineral Bodies.

It is a Chymical Complaint, even of the Curious and Experienc'd, that though Authors teach us to make the Salt of violently distill'd or calcin'd Vitriol, by forthwith taking the *Caput mortuum*, (from which all the Oyl has been by the violence of Fire forced out,) and extracting the Saline part by affusions of Water, yet those* that make exact tryals of it find, that when the dark red Mass of Powder is newly taken out of the Vessels, tis so totally robb'd of its Saline particles, that no Affusion of Water will at all obtain from it the expected Salt. Notwithstanding which, having purposely enquir'd of some, that distill great quantities of Oyl of Vitriol, whether or no, when they had made an end of one Distillation, if they lay by the *Caput mortuum* for a pretty while in the Air, they could not find it impregnated enough with new Saline particles, to be fit to yeild more Menstruum, and be worth another Distillation? I was answer'd in the Affirmative, provided that (as I mention'd in the state of the Case) there were a competent time interpos'd between the former and the latter Distillations. (The reason which, according to my Tryals and Conjectures, may be assign'd of this odd *Phenomenon*, belongs not to this place, but You will hereafter meet with it in another.)

The second Instance I promis'd You, is afforded me by Stones; for there are, and not far from this place, Quarries of solid and useful Stone , which is employ'd about some stately Buildings I have seen, and which yet is of such a Nature, wherein divers other sorts of Stone are said to resemble it, That though being digg'd at a certain Season of the Year, it proves good and durable, as in those Structures newly mentioned; yet employ'd at a wrong time it makes but ruinous Buildings, as even the chief of those Persons, whose Profession makes him more conversant with it, has himself
acknow-

acknowledg'd to me to have been found by sad Experience. But concerning this Observation, You may expect to meet elsewhere with a further account.

And though Time and Place be two of the principal, yet they are not the onely Circumstances, whose Variations may make some such Attributes discover'd in Natural Things, as are not usually heeded; of which I shall mention but a Couple of Instances, because they may serve to shew You, That such Circumstances as are thought the slightest, may afford new Uses even of Solid and lasting Bodies. Skillful Artificers, that grind Optical Glasses for Tubes, have complain'd to me, That oftentimes the convex Glasses they fashion, will prove Veiny, and consequently, after all their labour, of little value; and yet they are not able to discover these unwelcome Veins in the Glass, by the most careful viewing it against the Light, till they have spent a pretty deal of time about working of it, and even then they are unable to descry these Blemishes, if they hold the Glass at an ordinary distance from the Eye, but they are oblig'd to remove it a great way (perhaps 6 or 7 foot) farther, so much may an increase of Distance become serviceable, even where one would expect the quite Contrary.

But probably You will look upon Posture as a slighter Circumstance than Distance it self, and yet Dr *Gilbert* has observ'd, and I have found it true by many Tryals, That long Irons, as the Bars of Windows, that have stood upright for a great while, do, by that perpendicular Posture, acquire a Verticity or Magnetick virtue, as having acquir'd Magnetick Poles. So that if You apply the Needle of a Dial (which I mention as the readiest way of Tryal) to the lower part of the Bar, it will draw the South end of the Needle; whereas the upper Extreame of the Barr will seem to drive away that end, and will draw the Northern.

But here I must not forget to take notice, that I can scarce think

think Men will be able to know all the Properties and Uses even of familiar Bodies and other things, till they have Mathematically consider'd them; there being several Attributes belonging even to such things, which a Naturalist, though Curious, will probably never find out, unless he be both acquainted with Mathematical Disciplines, and have the Curiosity to apply them to Physical Subjects. And though in other Essays of this Book divers things are deliver'd, that do directly enough tend to manifest what I have now said; yet 'tis of such importance, that Naturalists should be thoroughly perswaded of a Truth, that may be so much more useful than 'tis yet generally admitted, that I am content to inculcate it by setting down here a few Instances of somewhat a differing sort from those elsewhere delivered, and more appropriated to the present subject of our Discourse.

You will not doubt, but that ever since the first Ages of the World, the majority of Men have had some occasion or other to see Bodies swing; and yet till *Galileo* (for he is generally believ'd the Discoverer) took notice of the Vibrations with a Mathematical Eye, men knew not this property of Swinging Bodies, That the greater and smaller Arches were, as to Sense, equitemporaneous; from which Discovery have been deriv'd several Practices of good Use, some of which have been already mentioned in these Essays.

That Water, running out at a Hole made in the sides near the bottom of the Vessel, makes a Parabolical line, or one that neer resembles it, and that in such effluxions of water there is a determinate proportion assignable betwixt the perpendicular height of the Liquor, and the Diameter of the Hole, whereby the Velocity and Quantity of Water that would run out, may be computed, has not been, that I know of, taken notice of, till the Observations of the above nam'd *Galileo* and the diligent *Mersennus* (to which we may elsewhere add some of our own) have endeavour'd to define those matters.

As

As constantly as we have occasion to take notice of Air, and Water, and Glass, yet the Curiosity of our modern Masters of Opticks has observ'd many things touching the Refraction of the beams of Light, made in those mediums in differing Quantities, and To and From the Perpendicular, not to say any thing of the Equality, of the Angles of Incidence, and of Reflection made on the Surface of still Water, unheeded by those that are not vers'd in Opticks: The drops of Dew, that hang in numberless multitudes upon the Grass and Leaves, are things that every Eye has been invited to take notice of, by the Orient colours the Sun is wont to make them afford us; but till the Excellent *Des Cartes*, *Meteorol. cap. 8.* contemplating them with a more Critical Eye, found, That in such a determinate Angle made at the Spectator's Eye, between the ray of Light coming from a certain part of the Drop, and the imaginary strait Line reaching from the Eye to the Sun's Center, the Drop appear'd red, and in another determinate Angle exhibited Yellow, Blew, and other Colours, and at other Angles shew'd no Colour at all, the World ignor'd a considerable property of Spherical Diaphanums irradiated by the Sun, and seems not to have dreamt of a neat *Hypothesis*, with which some Ingenious mens Minds are no less taken, than their Eyes are with those vivid colours of the Rainbow, which it pretends to give a clear account of. And though we daily see pieces of Wood and Timber broken by the weight of over heavy Bodies, yet till the often nam'd, and still to be commended *Galileo* apply'd Geometry and the Doctrine of Proportions to matters of this kind, the resistance of Solid bodies to be broken by Weight (whether their own, or that of other Bodies) seems not to have been so much as suspected to be reducible to such an Estimate, as he and others have brought it to. And a *Virtuoso* of my Acquaintance, (for whom *Mersennus* laid the way) in a Musical Instrument, that I have with pleasure

sure heard him play on, can observe a property of Metals that Chymists thought not of, namely, that equal Wire-strings made of differing Metals, and having a due Tension, will yeild Sounds, differing as to Sharpnes by determinate Musical Notes, or the Divisions of them. And to these I might add divers other Remarks of *Mersennus* and *Galileo* about the force of Guns, (which were found to increase with their Length but till such a number of Feet, beyond which the Length did but lessen it,) and the Parabolical line in which Bullets (that are thought of all other Bodies to move the straitest) are said to move; and I know not how many other Mathematical Attributes (if I may so call them) of Natural things, that Geometricians, Astronomers, Engineers, &c. have already observ'd, might be here added, but that I think it sufficient to subjoyn one Instance more, that may well serve to keep us from imagining, that even the most familiar Objects in the World, and that seem likely to afford the least Discoveries, have been sufficiently consider'd. For how few *Phænomena* in Nature are there, that occur to us more frequently than the falling of heavy Bodies? and yet though the Ancients and *Aristotle* himself took notice, that there was an Acceleration of Descent in falling Bodies, yet we find not that any so much as fairly attempted to determine that acquir'd Velocity, till *Galileo's* Observations reduc'd it to the Proportion mentioned in some of the former Essays, wherein most of the following Mathematicians (for I have scarce met with two Dissenters) have acquiesc'd; and whereby in the VIIIth Essay we endeavour'd to measure Heights and Depths without Geometrical Instruments. In a word, till Geometry, Mechanicks, Opticks, and the like Disciplines be more generally and skilfully applied to Physical things, I cannot think otherwise than that many of the Attributes and Applications of them will remain unknown; there being doubtles many Properties and Uses of Natural things,

things that are not like to be observed by those men, though otherwise never so learned, that are strangers to the Mathematicks.

And as I have hitherto observ'd of *Bodies*, so I shall venture to add of *Qualities*, and divers other Natural things, that even those, that are very familiar, may have Attributes and Uses, which the Generality of Men, without excepting those that are otherwise Learned, are not wont to take any notice of.

That Black bodies (for Instance) as such, are much more strongly and easily warm'd by the Sun beams than White ones, nay (though the disparity be not so great) than Bodies of any light Colour, *ceteris paribus*, is perhaps more than even You have taken notice of: and yet I shall hereafter have occasion to prove it by divers Instances, and You may easily try it, either by exposing for some time to the Summer-Sun a White Glove and a Black, or a couple of Eggs, whereof one is Ink'd, or otherwise Black'd, all over.

Cold is one of the most familiar Qualities Men have to deal with, and though they otherwise are not wont to expect much from it, yet least of all would they expect that it should, contrary to the receiv'd Definition of it, which is, *congregare tam Heterogenea quàm Homogenea*, that it should, I say, perform the office of Heat in Spirit of Wine, nay and in presenting us ardent Spirits from Beer and other Liquors inferior to Wine; and yet, not to mention *Paracelsus's* Process of making the Essence of Wine by freezing all the Flegm, we have the repeated Experiments of Navigators into the Frigid Zone, who assure us, that not onely from Wine, but from Beer, by the Congelation of the Aqueous parts, there may be separated or obtain'd a Liquor strong, hot, and Spirituous, almost like *Aqua vite*.

And even in our temperate Climate some odd Separations may be made by Cold; for, not to anticipate those tri-

als of mine that belong to other Papers, there may, by such Cold as we have here, be made a Separation in Oyl, of a Liquor much finer and more Spirituous than the rest; for I know an Eminent Artificer, who kept it as a choice Secret to resort (as himself confest to me he did) in hard Frosts to the great Jarrs of Oyl, where he often found greater or lesser Cracks or Chinks in the congeal'd part of the Oyl, in which Crannies was contain'd an unfrozen Liquor, that appear'd thinner and finer than common Oyl, and was much better than it to preserve things from rusting; (as perhaps having left many of its Saline parts in the Concreted Oyl,) and for that purpose was much priz'd not onely by him, but by some Watchmakers, that were made acquainted with the virtue of it.

But twere tedious to insist on all the Instances that may be brought, of the Applications that may be made of Colour, Sound, Levity, Springines, Fermentation, and even Putrefaction; and twould be not onely tedious, but almost endless to prosecute those Instances that might be afforded by other more general and operative states and faculties of Bodies. For not onely Motion and Rest, Fluidity and Firmness, Gravity, and the like, have a more universal Influence on Natural things, than even Philosophers are wont to take notice of: but those lesse Catholick Affections of Matter, that are reckon'd among but particular Qualities, such as Gravity, and Heat, may have so diffus'd an Influence, and be applicable to so many differing purposes, that I doubt whether all the Uses of that particular degree or Pitch of Heat that reigns in Fire, will have all its Uses discovered, before the last great Fire shall dissolve the Frame of Nature.

Nor must I pretermitt one consideration more, that belongs to my present Subject, which is, that probably many more Qualities (or other Attributes) would be taken notice of, even in those Natural things that are reckon'd among the
most

most known, if Men did not want a measure of Curiosity that might justly be expected. For I speak not here of Curiosity in general, (which I doubt not would make far more numerous Discoveries, than were necessary to justify my present Discourse,) but I onely speak of such a Curiosity about the things of Nature we familiarly converse with, as we could scarce want, if it were not out of Laziness, or a prejudicate Opinion, that makes us take that for granted, that we should find to be quite otherwise, if we did not choose rather to *presume* than to *try*.

Thus that falling Bodies, the heavier they are, the faster in proportion they fall, has been a receiv'd Opinion in the Schools since *Aristotle's* time, and has kept the Equivelocity (as to Sense at least) of Bodies of very differing bulks and Weights falling from moderate Heights (such as surpass not ordinary Towers and Sreeples) from being taken notice of, till of late Inquisitive men by Experiments found it out.

That Water by Glaciation is reduc'd into a lesser Room, has been and is still the opinion not onely of the Vulgar, but of the generality of Learned men; and yet that Water is not condens'd but expanded by freezing, he that will congele that Liquor in vessels strong enough, may easily find by tryal. And the floating of Ice upon Water, and the Bubbles that are usually to be observed in it, may alone suffice to make a considering man distrust the vulgar Opinion.

That the common Air we breath and live in, is a Body endowed with positive Levity, has been for many Ages, and continues to be almost universally believed; and yet if men had the Curiosity to examine this Supposition by one or other of those several wayes, by which the Gravity or Levity of the Air may be discovered, they would quickly find that tis not devoid of Weight. And even so slight a way as the condensing the Air in a blown Bladder, by tying a String something strong about the middle of it, may bear witness

to what we say. For though we should oppose, as some have lately done, That in such cases the Air is not in its Natural state, but condens'd; besides, that is an Objection, to which all the Expedients of weighing Air are no way liable, it makes rather against the Objectors, than the Conclusion against which they urge it; since, if the Particles of the Air be really light, the filling the Bladder the fuller of them ought to make it rather lighter than heavier.

That greater and lesser Sounds do, as to Sense, move with an equal Swiftneſs, is that whole Contrary is taken for granted; and the more excusably, because tis evident and confest, that great and small Sounds do not move equally far: and yet that this Equivelocity of Sounds has been made out by the late Observations of the diligent *Merſennus*, and others, you may remember to have been delivered in a * foregoing Essay, where I also endeavour'd to shew, That this property of Sounds is not unapplicable to Humane Uses.

*The IIX:

That the Loadstone, which by immediate contact will rake up Iron, should have so strange a Property as to take up far more when a Cap, or conveniently shap'd piece of Steel is interpos'd betwixt it and the Body to be rais'd, is a thing so unlikely, that though the Ancients knew and much admir'd the Attractive Virtue of the Loadstone, yet they seem'd not to have suspected it enough to vouchsafe it a Trial: and yet since *Gilberts* Writings came abroad, he must be a great Novice in Magnetical Affairs, that either ignores or doubts it. But I must not do any more than touch upon Magnetical Experiments, since they alone would afford me so many Truths (which the generality of men would not have thought likely enough to be worth trying) that to enumerate them, though it might convince Your Understanding, would I fear exercise Your Patience.

That tis the property of unslak'd Lime to grow hot by *Antiperistasis*, upon the pouring on of cold Water, and other

ther cold Liquors, and consequently not to grow hot upon the Affusion of Liquors that are not Cold, is not onely generally beleived both by Learn'd and Unlearned, but this property of Lime has been imployed as an Argument to prove other Matters, as well by divers of the new Philosophers, as by many of them that imbrace the old *Aristotelian* Principles: whereas I doubt not but a little Tryal might easily disabuse them: for by the Affusion of divers Liquors actually warm, I have made Lime flake with its wonted violence, if not with a greater. And in other Liquors actually Cold like unheated Water, and one or two of them far more thin or subtle than It, I have kept Lime long without flaking, and without imparting to the ambient Liquor any sensible Heat. The Quality of these Instances makes me think it needless to increase their Number, since we can scarce with a greater inducement to expect, that many new Attributes may be discovered in the works of Nature, if mens Curiosity were duely set on work to make Tryals, than that divers have been found out that seem'd so unlikely, that men thought it would be in vain to try them.

To these several sorts of Instances, that have hitherto been reduc'd to our first Consideration, might well be added, That Bodies which have the same Denomination, and from whence men are therefore wont to expect the same, and but the same, Operations and Uses, may yet have peculiar ones, and some of them very differing from those of the Generality of other Bodies that bear the same name. But Examples of this kind will more conveniently be mentioned in the last Essay: and least this should swell too much, dismissing this present Consideration, we will advance to the Next.

THE II. SECTION.

I Consider in the second place, That the Faculties and Qualities of Things being (for the most part) but certain Relations, either to one another, (as between a Lock and a Key;) or to Men, as the Qualities of External things referr'd to our Bodies, (and especially to the Organs of Sense,) when other Things, whereto These may be related, are better known, many of These with which we are now more acquainted, may appear to have useful Qualities not yet taken notice of.

I shall elsewhere, *Pyrophilus*, have occasion to shew You more fully on what Grounds, as well as in what Sense it is, that I take the most of the *Qualities* of Natural Bodies to be but *Relative Things*. To our present purpose it may suffice to adumbrate my Meaning by the newly hinted Example of a Lock and a Key, where, as that which we consider in a Key, as the power or facultie of Opening or Shutting supposes and depends upon the Lock whereto it corresponds; so most of those Powers & other Attributes that we call Qualities in Bodies, depend so much upon the Structure or Constitutions of other Bodies that are dispos'd or indispos'd to be acted on by them, that if there were no such Objects in the World, those Qualities, in the Bodies that are said to be endow'd with them, would be but Aptitudes to work such Effects, in case convenient Objects were not wanting. As if there were no Lock in the World, a Key would be but a piece of Iron of such a determinate Size and Shape. And this Comparison I the rather imploy, because it may be further applied to our present Discourse. For as if some barbarous *American* should among other pieces of Shipwrack, thrown by the Sea upon the Shore, light upon a Key of a Cabiner, he would probably look on it as a piece of Iron, fit onely for

for the inconsiderable Uses of any other piece of Iron made much broader at each end than in the middle, but, having never seen a Lock, would never dream that this piece of Iron had a faculty to secure or give access to all that is contain'd in some well furnish'd Chest or rich Cabinet: So there is many a thing that seems to us useles, whilst we look upon it only in it self, which will perhaps hereafter prove highly useful, when we shall light upon some other Bodies peculiarly fitted to act upon it, or receive impressiions from it. But this will be better apprehended by the following Instances.

Though Iron be so common a Body as it is, and its Uses are very many, and have been known as long as since *Adam's* time, yet all those differing Bodies, on which men of all sorts imploy'd it to work, and all those various wayes whereby Chymists, Physicians, and Mineralists have wrought on it during some thousands of Years, did never discover to man one of its noblest and usefulest Properties, which, for ought we know, was never found out till within these 3 or 4 Ages: for a Steel Needle, being applied to a Loadstone, manifested it self to be capable of constantly shewing the North and South in all Seas, in all Weathers, and in all times of the Day and Night to Navigators, who, by this Property, which depends upon the Relation that Iron has to one onely Stone, have been enabled to discover the New World, and enrich the Old with the Drugs and Treasures of it.

After all the vain Attempts that even subtle Chymists have made to arrest the Fluidity of Quick-silver, the knowingst Persons that have medled with that Mineral, and especially if they have observ'd that the keenest Frosts, that are capable of freezing even *Aqua vite*, are unable to congele it, have been very much indispos'd to reckon an easie Coagulableness amongst its Qualities; and yet we see, that though the Mixture of no other known Body will disclose its having any such Affection, yet the Vapor of melted Lead will sometimes

times (for that Experiment will not alwaies succeed) reduce Quick-silver even in its Mass into a consistent and somewhat tough and hard Body.

Vinegar being a Liquor, that has been generally known and us'd for some thousands of Years, men have imploy'd it upon great variety of Bodies, and to very many Uses, but especially to communicate a Sowerness to the things where-with twas mingled; but when it came (probably by chance) to be applied to the dissolving of Lead calcin'd or crude, it manifested that it had a faculty to exhibit a more than Saccharine Sweetnes, which, for ought I know, it exhibits with that Metal onely; for I have not yet known crude Vinegar dissolve Tin though Calcin'd; and though by a slight Artifice, elsewhere mentioned, we have been able to make strong Spirit of Vinegar dissolve the *Calx* of *Jupiter*, yet was the Solution far differing from, and inferiour to, the Taste of the Solution of Lead newly mentioned.

Spirit of Urine is a Liquor that has been long known to Chymists, and might reasonably be lookt upon as likely to be a good Menstruum for several Bodies: but tis not probable, that after it had been imployed to dissolve divers compact Bodies, it should be suspected, that it would coagulate so thin, light, and fugitive a Body as Spirit of Wine it self; and yet we have often (as there will be hereafter divers occasions to relate) tryed, that if both Liquors be sufficiently pure and dephlegm'd, they will afford that strange Snow-white Concretion that *Helmont* calls his *Offa alba*; which, however by his Followers ascrib'd to him as the Inventor, I find mentioned in ancienter Books than his: and I remember that even *Raymond Lully* relates, with what wonder he first saw this Experiment (which indeed is considerable) perform'd.

And as the Spirit of Urine has such an odd Property, when it meets with ardent Spirits dephlegmed; so the Spirituous parts

parts of Urine, without being separated from the rest, have a faculty that one may yet lesse expect, if they be duely imployed, to operate upon Musk: as I have had the opportunity to inform my self by inquiry of a Scholar, who lived in *China*, and affirm'd himself to have divers times seen Musk made. For this Person answered me, that he had observ'd it to be the Practice of others, and had made Tryal of it himself in those Eastern parts, That the Musk being made up, and put into Cods or Bags made of the skin of the same Animal, (in which form I have received Presents of Musk sent me from the *Indies*) they do either before or after hang it in a house of Office, so as it may, without touching the grosser Bodies, receive the fetid Exhalations of that Nasty place; by which Urinons Steams, which tis expos'd to for some dayes, the lesse Active or more immers'd Scent is, as it were, call'd out, and excited or heightened. And I found by farther Enquiry of the same Person, that having carried Musk from those Eastern Regions, where tis made, to other and remote parts of the same *Indies*, he found, That by the length of the Voyage by Sea his Musk had very much lost its strength, which he afterwards restor'd to it by following the Advice of some skillful Persons, according to which he tyed the Musk close in a Bladder, wherein having prickt many little Holes with a Needle, he hung it up for some dayes in such a stinking place as has been newly mentioned. Whereto agrees very well what I have read in a late Eminent Physician of *Rome*, (where the Art of Perfuming is very much cultivated) who communicates it as the chief Secret practic'd by the Perfumers there, for recovering the Scent of decayed Musk, That it be kept for a competent time in Linnen well moistned with rank Urine.

The uses of *Gesso* (as the *Spaniards* and *Italians* call it) or *Gypsum*, are numerous enough in the Shops of Stone-cutters, Moulders in Plaister or Wax, and divers other Artificers;

but one would scarce suspect, that besides the various uses these Tradersmen put it to, it should have one so very differing from them, as to be an excellent Medicine, if I may so call it, for Wine: and yet that they use great store of it about those Choice ones that comes to us from the *Canaries*, is a noted Tradition among those that deal in in that sort of Liquor, and has been confirm'd to me by an Eminent Wine-Merchant, that liv'd several Years in those Islands. And that about *Malaga* they put a good proportion of it into the juice of their Grapes, when they tun it up, is affirm'd to me by a Curious Eye-witness, who was there in Vintage time, and of whom I purposely inquir'd about it.

Though Silver be so Noble a Metal, and so much known and us'd, that twas the Price of things as early as *Abraham's* time, yet one very fine use of it has been known, but since the Art of Annealing upon Glasse came to be practis'd. For among other Experiments of this Art we find, that prepared Silver (and I have sometimes done it pretty well with the crude Metal) being as it were burnt upon a Plate of Glass, will tinge it with a fine Yellow or Golden colour: There are also divers Mineral Earths, and other course Fossiles, of use in this Art, which, by the help of the Fire, makes them impart colours to Glass, both transparent, and sometimes very differing from those of the Bodies themselves, as I may elsewhere have occasion to specify. In the mean time give me leave to name this Reflection upon the Art of Painting, That tis very hard for us to be sure that we know so much, as all the several sorts of Uses that may be made of the particular Bodies we converse with, since upon the invention of a new Art or Trade, of which we know not how many remain yet to be found out, divers Uses and Applications of Bodies come to be disclos'd, that were never suspected before.

The use of Lyes made with common Ashes to wash Lin-
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nen, has render'd them for these many Ages very familiar: But though their Effects on the other Bodies, upon which they have been employed, seem'd not to have any affinity with what I am going to mention; yet when a strong Lixivium is applied to Syrup of Violets, (which is also a very known Liquor) to which it has a peculiar Relation, it will then immediately change the colour of that Syrup from a Blew to a perfect Green, and so it will the Violet leaves crush'd on a piece of White Paper, without the help of Sugar, or any Preparation.

Redness, though a Colour as obvious as most others, and to the generality of men very pleasing, however it hath no offensive property in reference to other Animals, familiarly known amongst us, (at least that we have taken notice of:) yet being presented to the Eyes of Turkey-Cocks, it has such an incongruity with them, that oftentimes tis observed to make them very angry, as far as can be judg'd by the tokens of being displeased, it produces in them.

The Leaves of Oaks, that are such common things, and are not observed to have, in reference to any other Body, which Chance or Industry applies them to, any such Property as that I am about to name, these Leaves I say, if when fresh, they be immers'd in the water of Mineral Springs, impregnated with the subtle Corpuscles of Iron, I have several times found to turn the Liquor Blew or Black, according to the proportion and vigor of the two Ingredients.

One would not expect that so dark and black a Body as Char-coal, should be the main thing employed not onely to cleanse and brighten some Metals, but to procure a clearness, and give a Gloss to some transparent Bodies. And yet I learn'd from the makers of Mathematical Instruments, Gravers, and other Artificers, that the best way they have, and which I have seen them employ, to polish their Plates of Brais and Copper, (after they have been rubb'd clean with

powder'd Pumice Stone) is with Char-coal, (which some of the more Curious burn a second time, and quench in appropriated Liquors,) as that, which both serves to fetch out the scratches of the Pumice-stone, and it self scours without scratching, and thereby polishes very smoothly. And by the same way they may cleanse and polish the Plates of Horn, of which they make Lanthorns, Drinking Cups, &c. To which, as to the Metalline Plates, a Gloss may be afterwards given with Tripoly.

Perhaps it will not be improper to take notice to You, *Pyroph.* in this place, That not onely the Nature of the Body to be wrought upon, but some peculiar Circumstances relating to it, may contribute to the Effects of such Experiments as those treated of in this Section. As for Example, one would not expect that Water, which is so apt to run out at the Chinks of wooden Vessels, should, without addition, become the fittest Instrument for closing them. And yet I have more than once found by Tryal, as I presume many Tradesmen have done, that when wooden Barrels or Firkins, and the like Vessels, by having been long kept too dry, come to have Clefts and Commisures, this inconvenience may be remedied by pouring Water into them. For though at first the Liquor quickly runs out again, yet by frequent affusions of it, the Wood, especially those Edges between which the Water runs out, becomes so softned and plump up, that the little Intervals or Chinks are, by the swelling of the neighbouring parts, clos'd up, and the Vessel becomes staunch.

And upon a like Reason seems to depend that odd Experiment, much talkt of by some of our Eminent English Seamen, who, for the hasty stopping of a Leak that is not too great, much commend the thrusting into it a piece of powder'd Beef, for this being much more salt than the Sea-water, that liquor pierces into the compact and (in great part) dry

dry Body, and by opening the Salts, and soaking into the Flesh, makes the swelling Beef expand it self, so as to bear strongly against the Edges of the broken Planks, and thereby hinders the Water from flowing into the Ship as it did before.

THE III. SECTION.

I Consider in the next place, That a Body in association with others may be made fit for new Uses, and some of them quite differing from those that were proper to it before.

This III. Consideration is, in some regards, of Affinity with the first, but yet is not the same, since in the former we consider the Power that one Body has to act upon another, or the disposition it hath to be acted upon by it; whereas now we consider the two Bodies or more, as being by Conjunction qualified to act on a third Body, or suffer from it, as one entire Concrete, upon the account of new and emergent Properties, accreuing to the Compound by the Association of the more simple Bodies that compose it.

You will meet with store of Instances, both in these Essays, and other of my Writings, easily applicable to the illustration of what is here delivered, and therefore it will suffice to name in this place the fewer.

He that takes notice how flexible a Metal Tin is, and how dead a noise it yeilds, will scarce dream that one of its Uses, and that none of the despicablest, should be to make another Metal, which is lesse yeilding, and has a lesse dead Sound than its self, not onely hard, but sonorous: and yet we see, that Bell-Metal, which, when cast into Bells, makes a hard Mixture that sounds so lowdly, is made principally, as has been already noted, by the addition of a certain proportion of Tin to Copper.

In the common Experiment of making Ink, the Infusion or Decoction of Galls is yellowish, or reddish, and the Solution of Vitriol will, as the Concrete participates more of Iron or of Copper, be either green or blewish; but from the mixture of these two Liquors there will emerge an Inky Blackness.

That Oyl, that is a Body so mollifying and slippery, and whose Unctuosity makes its moisture so much more difficult to be wasted or destroyed than that of Water, Wine, or other not tenacious Liquors, should be one of the 2 or 3 main Ingredients, and the onely moist one of a hard and durable Cement, is that which probably You would very little expect from it: and yet, not to mention what Trials of that nature I have made, because I had not time to observe the full Event, a very ingenious man, much employ'd about costly Water-works and Dams, assures me, That the best way he has to joyn together, and, if need be, piece and mend with a close and lasting Cement the Pipes, that are us'd for subterranean Aqueducts, that are long to hold running Water, is to take good Clay (such as Tobacco-pipes are made of,) and having dry'd it, and reduc'd it to very fine Powder, and mixt good store of short Flocks with it, beat it up very diligently with as much Linseed Oyl, as will serve to bring it to a stiff Past, almost like well kneaded Dow. This Past he fashions into Pipes of the length and bigness required, which though they will be long a drying in the Air, yet, when once thoroughly dry, are very stanch and lasting. And I remember, that before I learned this, having occasion to try divers Experiments about Cements, I chanc'd to meet with an ancient Artificer, employ'd to keep in repair the Conduits that brought Water to *London*, and in exchange of a Lute or Cement that I taught him, he was forward to satisfy the Curiosity I had to know what Cement he employed about so important a Work, and he assur'd me, That Oyl was

was one of the main Ingredients (and the onely Liquid one) he imployed.

He that considers that Lead is one of the most opacous and flexible Bodies that the World affords us, will not easily imagine, that one of its Uses should be to make up about 3 parts of four of a Mixture transparent, and exceeding brittle; and yet this is easily perform'd by divers Chymists (and I elsewhere mention my having often done it) in making of calcin'd Lead, and powder'd Flints or Sand, a brittle and Diaphanous Composition, call'd by Spagyristes *Vitrum Saturni*.

And this mention of Glass suggests to me another Instance, fit for my present purpose: for who would imagine that such a Body as the fix'd Salt of Chaly, which, as other Alkalies, that take their Denomination from it, has a strong and fiery Taste, and is not onely readily dissoluble in Water, Wine, or any such liquor, but will in a short time, being but left in the Air, be reduc'd into a Liquor; who would expect, I say, that it should be of any Use, much less the Main of this Caustick, and easily dissoluble Body, to be one of the two main Ingredients of Substance both perfectly insipid, and indissoluble, not onely in Water, Wine, &c. but even in *Aqua fortis*, *Aqua regia*, Spirit of Wine, Quick-silver, Spirit of Urine, and other Menstruums, some of them highly Corrosive, and others extremely subtle and piercing: and yet such a Mixture is usually afforded us in Glass, (especially the most durable sort of it) wherein, That there is actually a great proportion of Alchalizate Salt I confesse I doubted, till having purposely enquired of an Ingenious Master of a Glasse-house, how much Glass he usually obtained when he put in such a Quantity of Sand, I found by his Answer, That the Glass obtain'd was many Pounds in the hundred more than the Sand that was imploy'd to make it, whence I gathered, (what he also affirm'd) That the Alcaly did not onely seem

(as one might suspect) to promote the Fusion of the Sand, but does materially and plentifully concur with it to compose the Glass.

And whereas I intimated at the very beginning of this 3^d Section of this Essay, That Bodies, when associated, may be applied not onely to new Uses, but perhaps to some that are quite differing from those that belong to some of the respective Ingredients. This Observation may be made good by several Instances, and even by some that are very obvious, as well as by others that are not so familiar. For we may take notice, that though Oyl, and Tallow, and other such Unctuous bodies, be those that do grease and spot Linnen and Wollen Cloaths; yet those very Bodies, being skilfully associated with others, though with but a Lixiviate Salt and fair Water, do plentifully concur to the making up of Soap, by the Solution of which, Grease is readily wash'd out of Linnen Cloaths, and others besides those are also freed from the Spots of it. But divers other Instances applicable to this purpose, belonging more properly to the following part of this Essay, till we come thither it may suffice, that I illustrate and confirm what hath been propos'd by the single, but noble instance of *Aurum fulminans*. For though Salt of Tartar be a fixt Body, and of a fixing Quality, yet being skilfully associated with Gold dissolv'd in *Aqua Regis*, though that be thought the fixedst, not onely of Metals, but of Bodies, yet the Gold precipitated by this fixt and incombustible Salt, becomes so exceeding fugitive, that By a gentler heat than would kindle any known Body in the World, it is made to Fulminate like Gun-powder, (but many degrees more violent than it;) and (which you will also think strange) though *Sulphur* be a Body of so quick Accension as is obviously known, yet by an easie way (elsewhere to be taught You) of mixing those two onely, You may, as Tryal hath inform'd us, make it (which You will easily allow to be one of

of the unlikeliest uses of Sulphur) even by its being set on fire, to hinder the Accension of this so easily kindled Gold, which I have known thereby readily turn'd into a Medicine, that some cry up for excellently Diaphoretick, (though I doubt whether *Aurum fulminans* work not rather another way,) and which I remember I have (in a Crucible) kept long in the fire without losse.

I shall onely adde to this third Consideration this one particular, that is of too great moment to be pretermitted here, though it have been already in part taken notice of on another occasion, namely, That the Effects and Uses of Mixtures do not onely depend upon the nature of the Ingredients, but may be oftentimes much varied by their Proportion. And of this the Mineral, which at the Glass-houses they are well acquainted with, under the name of *Manganese*, will afford us a pertinent and considerable Instance. For though it be a course and dark Mineral it self, and though being added to the Materials of Glass in a fuller Proportion, it make the black Glasses that are sold in shops; yet not onely a moderate proportion of it is us'd to make Glass red, but which is more remarkable, a small and due proportion of it is commonly employed to make Glass the more clear and Diaphanous.

THE IV. SECTION.

IN the Fourth place I consider, That a Body, by a differing preparation or management, may be fit for new, and perhaps unthought of, Purposes. For the Qualities of Bodies depending for the most part upon the Texture of the small parts they are made up of, those wayes of ordering greater Bodies, which do either by Addition, Detraction, or Transposition of their Component Corpuscles, or by any two, or all of those wayes, make any notable Change of the former

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Texture of the Body, may introduce new Qualities, and thereby make it fit for diverse Uses, for which twas not proper before.

We see to how many several Uses Men, that were neither Philosophers nor Chymists, but for the the most part illiterate Tradesmen, have been able to put Iron, by but varying the visible Shape of certain Portions of it, and connecting some of them after a peculiar manner: as is obvious in the shops of Blacksmiths, Lock-Smiths. Gun-Smiths, Cutlers, Clock-makers, Iron-mongers, and others. But to give You a more Physical Instance in the same Metal, be pleased to take notice, how much a Change, made by a Natural Agent, the Fire, in the invisible Texture of Iron, does speedily alter it; when of the same Bar of Iron, by the help of Fire and Water, the Artificer makes harden'd Iron, and Iron of a temper fit for Drills, and Knives, and Springs, and I know not how many other Instruments, which require distinct Tempers in the Metal they are made of; that Temper which renders them fit for one use, leaving them unfit for another.

But we need not confine our selves to Instances, wherein no new Ingredient is added to, or taken from the Body to be alter'd, it being sufficient, that the Additament upon its own account do not bear so great a stroke in the Change produc'd, but that it be principally ascrib'd to the way of ordering the Body wrought upon; and speaking of the management of a Body in this Sense, (which is usual and proper enough,) I shall subjoin a few Instances, of the many I might adde, to make good our Proposition.

Though Paper be one of the commonest Bodies that we use, yet there are very few that imagine it is fit to be employ'd otherwaies than about Writing, or Printing, or wrapping up of other things, or about some such obvious piece of Service, without dreaming that Frames for Pictures, and divers
fine

fine pieces of Emboss'd work, with other Curious Moveables, may (as Trial has inform'd us) be made of it, after this or the like manner. First, soak a convenient quantity of whitish Paper, that is not fine, about 2 or 3 dayes in water, till it be very soft; then mash it in hot water, and beat or work it in large Mortars or Troughs, (much after the manner us'd in some places to Churm Butter) till it be brought to a kind of thin Pap, which must be laid on a Sieve (without pressure,) to drain away the superfluous Moistnes, and afterwar'ds put into warm Water, wherein a good quantity of Fish-Glew or common Size has been dissolv'd. Being thence taken out by parcels with a Sponge, it must therewith (for the Sponge will dry up the superfluous moisture) be press'd into Moulds of Iron, or of such Plaster as Statuaries use, wherein having acquir'd the Figure which is intended to be given it, it is thence to be taken out, and permitted to dry, and is to be strengthned, where need requires, with Plaster, or grated Chalk (made into Pap with Water,) or some other convenient matter; and afterwards, having first been leisurely dried, tis to be either painted or overlaid with foliated Silver or Gold, as the Artist pleases. I may elsewhere have occasion to mention another unlikely use of Paper, namely, to stop the Clefts & Commissures of Wooden Instruments and Vessels, that are to hold Water. For Paper being thrust into these narrow places, the first Water that comes to it being soakt up, occasions a forcible Dilatation, which makes the swelling Paper fill the Chinks tis lodg'd in, according to what was lately deliver'd at the close of the second Section.

The Sugar-Cane has been a Plant well enough known to many Countreys and Ages, who were not unacquainted with the Sweetness of its Juice, and yet seem never to have made Sugar of it, for want of knowing the way of so ordering it, as to coagulate it into a Durable as well as Delicious substance.

Tobacco was likewise a noted Plant in the West-Indies, which was yet suffer'd yearly to rot and perish like other Herbs, till the Industry of the Moderns finding the way of Curing it, (as they call the method of Ordering it) made it, by the help of meer Skill, last in an improved condition for divers Years, and fit to be transported (as it plentifully is) over all the World.

The Leaves likewise of *Indigo*, which would uselessly perish like those of other Shrubs; by the meer way of ordering them, which too is rather by Substraction than Addition, has been long made a lasting Pigment or Dying stuff, and one of the most Staple Merchandises that even the East-Indies send us.

I might add the great Use that we are enabled to make of Madder, Woad, and divers other perishable Plants, by the way of ordering them; but there is one Instance of this kind so considerable, that though I have formerly nam'd it to another purpose, and though I am willing to mention but one Example more of this sort, I cannot but pitch upon this, since it excellently manifests what may be expected from a skilful ordering of Natures Productions, by shewing us, what even the Savages of *America* have been able to perform in this kind. For though their *Mandioca* be confessedly a Poysonous Plant, yet without Addition they make of it their *Cassavi*-Meal, whereof not onely the *Indians*, but also many *Europeans* make their Bread, (which I also have made some use of without dislike.) And with no Addition, unless it be perhaps that of Spittle, they make of the poysonous Juice of the same Root a not unpleasant nor strengthless Drink, which divers even of the *English* compare with our Beer. And of the Bread made of that *Cassavi* Root, they brew, in some of our *American* Colonies, a Liquor by the Planters called *Perino*, which I have known, even by Persons of Quality, equall'd if not preferr'd to Wine it self.

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The Shreds of Leather par'd away and thrown aside by the Glovers, by so slight a way of ordering them, as onely the boyling them long in fair Water, dissolves them in that Liquor, and reduces them with it, the Decoction being strain'd and cool'd, into a kind of Gelly that they call Size, (which may be also made the same way of Cuttings of Parchment, and better yet with those of Vellim,) which is of great use towards the Production of very differing Trades: some of which Productions are already touch'd upon in this Book, to which I shall here onely add, for the easiness of the Experiment, That the fine red Stands, and Hanging-Shelves, are made with ground Vermilion being onely temper'd up with it, and laid upon Wood, which being thus colour'd, is, when it is dry, laid over with common Varnish, which preserves it from Wet, and gives it a Gloss.

It would scarce be suspected that so white a Body as Ivory, should, among other uses, be proper, without the addition of any Black, or so much as dark-colour'd body, to yeild one of the deepest Blacks that has been hitherto known; and yet many of our Eminent Painters count that Black, which they call Ivory-black, the perfectest that hath been hitherto employed in their Art. And this Sable may be made of Ivory without Addition, onely by burning it a while in a close Pot; and we have made it by keeping it a while among Coals and Ashes, onely wrapt in store of wet Paper to keep it from spending its denigrating Sulphur in an actual Flame; (to prevent which, the Pots, it is burnt in, are wont to be clos'd with Lute, or otherwise sufficiently stop'd,) as if Artificers were acquainted with the old Rule, *Adusta nigra, perusta alba*

And on this occasion I shall add, That this Black made of Ivory is so excellent in its kind, that I scarce know any thing so proper to make Foils of, for that noblest sort of Gems, Diamonds. And I remember, that a very skilful Jeweller,
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of whom I bought some of those Stones, and whom I employed to set others for me, confest to me, That burnt Ivory was the thing he made use of, for Foils to the Diamonds he had a mind to set well.

Another Instance there is, which I must by no means pretermitt, now that I am endeavouring to shew, What the Preparation or management of a Body, even by illiterate Tradesmen, may do to make it fit for unlikely Uses. For one would scarce imagine, that from so gross and foul a Body as the *Intestinum rectum* of an Oxe or Cow, there should be obtain'd a transparent Substance, more thin by far than Paper, and yet of so great a firmness and toughness, as is scarce at all credible to those that have not been (as I have) convinc'd of it by Experience. But tis certain that some of our Gold-beaters in *London*, and perhaps not there onely, do, by cleansing and otherwise preparing the above mention'd nasty Gut of an Oxe, obtain exceeding fine Membranes, some of which I keep by me, that though clear and strangely thin, are yet of such tenacity, that when the thin Plates of Gold are put between them, or in their Folds, the force of a man frequently striking them, with a vast Hammer made of purpose, almost as heavy as he can well lift up, does usually, as I have seen with some wonder, attenuate and dilate the included Gold, without being able to break these so fine Skins.

These Instances, *Pyrophilus*, we have hitherto produc'd, are almost all of them such, as either Nature her self, or Nature assisted but by Tradesmen, and other illiterate persons, has presented us. And therefore questionles the Power that a skilful Management may have to produce great Changes in Bodies, and thereby fit them for new Uses, will be much advanc'd, when they shall be order'd by such as are either good Chymists, or dexterous at Mechanical and Mathematico-Mechanical Contrivances, especially if in the same Persons a skill in these two sorts of Knowledg should concur.

That

That skill in Mathematicks may teach a man so to manage Natural things, as to enable him to make other Uses of them than those that want it will dream of, we may be perswaded by several Particulars. For we see that from a bare giving to a piece of ordinary Glass a Prismatical shape, that Diaphanous and colourless Body may be made to exhibit in a moment all those delightful and vivid Colours for which we admire the Rainbow; and though meerly by giving a piece of foliated Glass or Metalline *Speculum* a Concave figure, it may be made to burn strongly by Reflection, yet by giving a piece of Glass a Convex figure, You may qualifie it to burn by Refraction, and even with Water firely figur'd You may readily kindle Fire. For though a round and hollow Spherical vial of pure Glass will transmit the Sun-beams without making them burn, and consequently has not of it self the faculty I am going to name, but serves chiefly to terminate the Water that is to be pour'd into it, and give it its due figuration, yet by filling a Spherical Vial, I have taken pleasure so to unite the Sun-beams, as when Frost and Snow was about me, to make them burn; (and perhaps Ice it self, if chosen free from Bubbles, and conveniently shap'd, may, as some incomplete Tryals make me hope, be made fit enough for that purpose.) And much more vigorous the Accention would be, if two bare Concave Glasses of like shape, equal bigness, and truly ground, had their Edges so joyn'd by a close Frame, that the Cavity contain'd between the inside of the Glasses and the Frame, may be fill'd with fair water; for by this means (the Convex side of each Glass being outermost) the whole Instrument (one or two of which I have seen in a *Virtuoso's* hands) will serve for a double Convex Glass, which may by this means be made far larger, and more efficacious than other Burning-Glasses of that figure, which consisting each of them of a single piece of Solid Glass, are wont to be far inferiour in bignes to such hollow ones,

ones, as may be easily enough attained.

And now I have named Solid Glass, give me leave to take hence a Rise to adde, That though Glass stopples are made onely by giving them an almost Conical figure, and a *superficies* fitted by grinding, for an exquisite Contact with the inside of the neck of a Glass-bottle; yet this way of ordering Glasses, which is ascribed not to meer Philolophers, but men vers'd in Optical and Mechanical Trades, produces Stopples much surpassing all known before; not onely in this, that neither *Aqua fortis*, nor other Corrosive Liquors work upon them, but also in their being able to keep in even the subtlest Spirits so strictly, that I remember having once forgot some Spirit of *Sal Armoniack* in a large Bottle, which it did not neer a quarter fill, when I long after (as I remember about seaven Years) came to that part of *England* again. I chanc'd to find this Bottle in a place, where being without an Inscription, I knew not what the contain'd Liquor was. And taking off the Glass-stopple, to discover by the scent what it might be, upon smelling to that solid Body, the adherent Spirits operated strongly enough upon my Nose and Eyes to make me almost stagger, and with my Curiosity had been more Cautious.

What I have further observ'd about the way of making, and the Applications of, this kind of Glasses, belongs not to this place, where twould be fit to prosecute my former Discourse by shewing You, How much the Chymical management of things may alter and improve them; were it not that it would be improper to venture upon so copious a Subject in one of the Sections of an Essay, where I shall therefore but point at it, without pretending to treat of it.

We see, that Chymists can out of some Fruits, that grow wild in the Hedges, and are not edible, as also out of the Lees of Ale and Beer, draw an inflammable Spirit, which, for many purposes (not Medicinal,) may be made use of for
that

that of Wine. We see that out of the dry Body of Hartshorn, as likewise out of the Skull and Bones of Dead Men, and other Animals, which have been wont to be lookt upon to be so devoid of Moisture, that Men Proverbially say, *as dry as a Bone*, Chymists do ordinarily, to the wonder of the Ignorant, draw store of Spirit, and Oyl, and Flegm, as they likewise do from the dryest Woods. Some of them also, of the opacous Body of Lead mixt with Sand, and a few Grains perhaps of Metalline Pigment, can make in a few hours variety of Amauses or Metalline Stones, which by their Transparency and lovely Colours do pleasingly emulate Rubies, Emeralds, and other native Gems; about the imitation of which, I may elsewhere acquaint You with some of my Trials.

How unlikely Effects may be sometimes produc'd by a slight Spagyricall preparation of things, may sufficiently appear by the *Bolonian Stone*, from which (though one would not upon the sight of it expect any such matter, yet) being duely prepared by Chymical Calcination, it acquires that strange *Property of shining in the Dark a while after it has been expos'd to the Sun*, for which it is so justly admir'd by us that have seen it, that tis judg'd unfit to be believ'd by many Criticks that have not.

And here let me take notice to You, *Pyrophilus*, That very slight Circumstances in the Management of a Body may sometimes produce considerable and unlikely Effects.

That Salt, dissolv'd in Water, is a powerful hinderer of the Congelation of that Liquor, is a matter of common Observation; neither the Sea-water, nor Brine, being usually frozen with us by such Frosts as turn common Water, and some Liquors more indispos'd than that is, into Ice: And yet Sea-salt, which being dissolv'd in Water keeps it from freezing, being outwardly applied to Water, does so powerfully concur with Snow or Ice to make it freeze in

Artificial Glaciations, and is so necessary to the effect, that the Snow or Ice without the Salt would not ordinarily here in our Climate produce in a seasonable time any Ice at all, as I more than once purposely tried.

There is a certain Powder, which by the Proportion and Mixture of Nitre (whereof it chiefly consists) with other Ingredients, obtains so odd a Texture, that if putting it into a Crucible you should place that upon the Coals, as is usually done in other Fluxes, the Powder would blow up or take fire with violence enough, and perhaps not without some danger; and yet if instead of kindling this Powder from the Bottom upwards, you kindle it from the Top downwards, there will be no danger in it, but it will make a powerful Flux for the reduction of Metalline Powders mixt with it into a Body.

THE V. SECTION.

IN the Vth and last place I consider, That the Generality of Effects to be performed, being not produc'd by one single and unassisted Production either of Nature or of Art, but requiring the Concurrence of More; he that knows not the Nature or Properties of all the other Bodies, where-with that on which the Experiment propos'd is actually, or may be usefully associated, or otherwise employed, can hardly discern All the Effects the Experiment may possibly concur to produce. For whereas many Inventions or Operations consist as it were of several parts, and require as it were distinct Actions; a Body that seems uselesse to the main and ultimate Effect, may usefully concur to the performance of some intermediate or subordinate part of the Operation, (by being requisite to which, it may be of use to the Experiment consider'd in the Gross, though not to each distinct part of it.)

Though

Though Spirit of Wine will scarce (if at all) even in a very long time draw a red Tincture out of the Flowers of Sulphur, yet when they have been opened, by having been flux'd together with an equal weight of salt of Tartar, we have found that they will in a few Minutes, and in a gentle heat, give, in thoroughly deflegm'd Spirit of Wine, a Tincture or Solution as red as Blood; which being freed from the superfluous Menstruum, will afford us a Balsom much finer than that vulgar one, which is wont to be made of the same Flowers dissolv'd in Oyl of Turpentine.

That such Amalgams of Gold and Mercury, as Goldsmiths are wont to guild Silver with, cannot by ordinary wayes be made to adhere either to Iron or Steel, is a thing so well known among Gun-Smiths, and such Artificers as work upon Iron, that when I enquir'd of several of them (as well *Dutch* as *English*) whether they could guild Iron with Water-Gold, (as they call that way of gilding, by the help of Quick-silver,) they judg'd it a thing not to be done: and yet I know a very Ingenious Tradesman, who was able to perform it, but not (that we may apply this Experiment to our present purpose) without the assistance of another Body, which was to perform one part before the Amalgam could perform the other. The Artificers way was to coat (if I may so speak) the Iron or Steel to be guilt, with a Coat of Copper, to which purpose he us'd distill'd Liquors temper'd with other Ingredients, wherein the Iron was to be immers'd with great wariness and Dexterity; for otherwise not onely the Tryal would not succeed, but oftentimes the Iron would be spoil'd. To obviate which inconveniencies there occur'd another way of Casing the Iron with Copper, namely by dissolving very good Vitriol that has Copper in it (for tis not every Vitriol that is fit for the purpose) in warm Water, till the Liquor be satiated with Vitriol, and immersing several times into this Solution the Iron, first

scoured till it be bright, and suffering it each time to dry of it self; for this Immersion being repeated often enough, there will precipitate upon the Iron enough of the Cupreous parts of the dissolved Vitriol, to fill all its superficial Pores with particles of Copper. So that by this safe, cheap, and easie way, having as it were overlaid your Iron with Copper, you may afterwards guild it as Copper with the above mention'd Amalgam, which will adhere to Copper, though not to Iron.

But here we must not omit an Observation very considerable to our present scope, namely, that though the several parts of an Experiment or a Process, may in most cases each of them be purely Physical, or Chymical, &c. yet in divers other cases it may far more usefully be so order'd, that one part of it may be Physical, (taking here that Term in contradistinction to subordinate parts of Learning) and several or each of the rest may belong to other Arts, as one may be Chymical, and another Statical, another Mechanical, another Hydrostatical, &c. and by such a Concurrence of differing parts of knowledge to the same Operation or Production, I doubt not but many things may be perform'd that have not yet been attempted, nor so much as thought of. For he that has skill but in one of these single parts of Learning, must needs have his Attempts as well as his Knowledge much straitned, by confining himself to operate by such Means and Instrument as are within the compass of his own Art; which assisted by others, may bear a good part in the performance of diverse considerable things, which tis by it self very insufficient to accomplish.

Of this we may take notice of some Instances in the productions that Art and Nature have presented us with already; for not onely Handicraft Trades, as we have formerly noted, do many of them assist each other in their Operations, but even those Arts that are counted ingenious, have some-
times

times need or use both of the service of the more Mechanical Trades, and of mutual Assistance among themselves. The Masters of Catoptricks know very well what would be the Properties of Spherical, Cylindrical, and other *Specula*; but to procure such *Specula* you must have recourse to the Chymist, or the Founder, whose part it is by Artificial Mixtures of Metals and Minerals, and by Mechanical Contrivances, to cast Bodies that give a more sincere and vivid Reflection than the single Metals would do, and to give them withall that curious Polish for which the Metallists and Chymists are beholding to Smiths, Stone-Cutters, Watch-makers, or other Handycrafts men.

Another eminent Example to the same purpose may be taken from the Consideration of Organs us'd in Churches. For to devise the Rules of making them well, there is First requisite no small skill in the Speculative part or Theory of Musick: next, he that would make the Instrument well, must know how to choose Wood proper for that purpose, (most Woods being unfit for it,) *how* to season it, and *how* to discern whether it be duely season'd, and otherwise well condition'd. To excavate and fashion the Pipes, and other parts of the Instrument that are made of this Wood, there is use of the Turners and Joyners Crafts. It is often needful also that the Organ-maker be skill'd in the effects of Metals, and perhaps their Mixtures; and the wayes of Casting them, in order to the making of his Pipes of a Sonorous matter, and to the giving them a due Shape, and other desirable Qualifications. I might here borrow further Instances from Bells, Lutes, Harps, and other Musical Instruments; but I hasten to Examples of another kind.

He that has never so attentively considered the Nature of Salt-petre, or of Brimstone apart, shall never be able to make the considerablest Uses of either of them, till he skillfully associate them to one another, and incorporate them
into

into that wonderfull Body call'd Gun-powder, which will afford us an Instance fit enough to explicate what we have been saying: for consisting of three differing Ingredients, Nitre, Brimstone, and Charcoal, though neither of these be sufficient *in omni genere* (as they speak in the Schools,) yet each of them is very useful by being sufficient *in suo genere*, and really concurs to the effect produc'd by them all, as you may elsewhere find more particularly declared.

He must remain ignorant of another considerable use of Sulphur, that is unacquainted with some Properties of common Oyl and calcin'd Alabaster. For Artists have a way of making Moulds, wherein to cast off the Impression of Medals, and other works emboss'd on Metals, which though the Effects of it seem strange to those that know not how they are produc'd, they easily thus perform. They make about the emboss'd work, whose Impression they desire to have, a little Border or Ledge of Clay, to hinder the melted Sulphur to be poured on it from running over; then they lightly (but very carefully) with a Pencil or Feather anoint the Metalline Work with Oyl, to hinder the Sulphur from adhering to it: then they melt good Brimstone in any convenient Pot, (which they cover well to prevent its taking Fire) and whilst tis hot they pour it gently upon the emboss'd Metal, all whose Extancies will make perfect Impressions on the lower Surface of the thus melted Brimstone, which ought to be poured on in a considerable quantity, that the Moulds thus made may prove the stronger. About the edge of this Mould they make a little Rimme or Border of Clay as before; and lightly anointing both all the Surface of the Mould and the inside of the Clay with Oyl, (which if it be too copious, is (as we have tried) apt to prejudice the accuratenesse of the Impression,) they pour in by degrees to the thickenesse of about $\frac{1}{4}$ of an Inch of that Mixture I formerly mention'd (in the 8th Essay,) to be made of recently cal-

calcin'd Alabaster, stirr'd and incorporated with such a quantity of fair Water, as may suffice to bring it to the consistence of the thicker sort of Honey. And this Mixture in about a Quarter of an Hour growing hard, and then being taken out of the Mould (to which the Oyl hinders it from sticking) will, if the work have been dexterously done, and the Mixture before Affusion carefully freed from Bubbles, perfectly exhibit the Shape and Dimensions of the Work Emboss'd upon the Metalline Pattern. And by this way in a few Minuts have we sometimes cast off a Coyn, a Medal, and sometimes too a whole Landscape, without any trouble, and not without some delight.

And here, *Pyrophilus*, let me performe what I lately intimated an Intention of, by now taking notice to You in this *fifth* Section of this Essay (of what I had not long since occasion to observe in a former part of it,) That You may oftentimes find such particular Bodies conducive to the main Effect of an Operation or Experiment, by performing some subordinate part or office in it, as yet may seem nothing at all of kin to the ultimate Effect promised by the perfected Experiment.

That *Aqua fortis*, that so greedily corrodes and devours Silver, and Brass, should eminently conduce to the real Silvering over of the latter Metal by the former, is that which few Goldsmiths, or even Chymists would judg probable. And yet this fretting Liquor performs a principal part in that ingenious way of Silvering over Brasse and Copper, which is more applauded than known. For first, *Aqua fortis* serves very well to make clean such Emboss'd, or otherwise uneven pieces of Metal, whose Inequality hinders us from being able to cleanse their little Cavities with Tripoly, or those other Powders commonly used to scour Brass: whereas if such Bodies be lightly wash'd over with *Aqua fortis*, and immediately thrown into fair Water, the Foulness may be fretted

fretted off, and the work not disfigur'd. And this is esteem'd the best way of scouring such Metalline pieces of work by the best Maker of Mathematical Instruments that I have met with. And I the rather mention it to You, *Pyrophilus*, because that though it be not alwaies requisite to our Experiment of Silvering, (for many pieces of Brazen work may well enough be made clean after the ordinary manner) yet divers Trials have assur'd us, that the scouring of the Brass and Copper is necessary to the success of this Experiment; probably because any Grease or Filth remaining upon the surface of the Metal, is sufficient to keep out those little parts of dissolv'd Silver, which ought to lodge themselves so thick in the pores of the Metal, as to seem one continued Silver'd body.

The remaining part of this Operation may be thus perform'd. The Metal to be wrought upon being made very clean, you must dissolve good Silver (the finer the better) in *Aqua fortis* in a broad bottom'd Vessel of Glass, or at least of glaz'd Earth; & having over a Chafing-dish of Coals, or with some such heat, evaporated away all the *Aqua fortis*, you must upon the remaining dry *Calx* pour off Water 5 or 6 times its quantity, or as much as will be needful perfectly to dissolve it. This Water with the like heat must be forc't away as the former *Mensstruum*, and the like quantity of fresh water must be pour'd on, and evaporated quite away the second time, and if need be the 3^d time, toward the later end making the Fire so strong as to leave a perfectly dry *Calx*, which, if your Silver has been good, will be of a good White, and will by these Operations be competently freed from the stinking and fretting Spirits of the *Aqua fortis*. Of this *Calx* you must take one part, and about as much (in Quantity, not in Weight) of common Salt, and as much of Chrystals of Tartar (or at least Powder of good white Tartar) as of either of the former Ingredients; which, like
this

this, ought to be finely beaten, and these three Powders being exquisitely mixt, you must plunge the scour'd Brasse, to be silver'd over, into fair Water, and then taking up as often as need requires with your wet fingers some of the newly mention'd Mixture, you must rub it on well till you find every little Cavity of the Metal sufficiently silver'd over; remembering, that if you would have it richly done, you must rub in more of the Powder. And last of all, you must wash well your silver'd Metal in fair water, and rub it very well, and hard with a dry Cloath, that it may appear smooth and bright. And this way of Silvering, though it be presently and cheaply perform'd without Quick-silver, yet may be made to last some Years, as Experience has partly inform'd me, and may be easily renewed when the Silvering begins to decay or wear off.

And here *Pyr.* it will not be improper to give You this Advertisement. That we ought not to conclude, as we are very prone to doe, that such an Use is not to be expected, or endeavour'd to be obtain'd from such a thing, because we see the like Use to be made of things that are thought to be of a quite differing nature from that we consider, or perhaps quite contrary to it: for in many cases, as there are more wayes than *one*, or even than *a few*, to bring to passe a thing propos'd; so among the various Instruments that may be employ'd the same purpose, some may exceedingly differ between themselves as to other Qualities, and yet agree in that which is requisite and sufficient for the performance of the thing design'd. As though, for Instance, Rosin and Sal Armoniack be differing in Colour, Smell, Taſt, Weight, Hardnesse, &c. though the one be a vegetable concrete juice, the other an aggregate of Urinous, Fuliginous, and Marine Salts; the one readily dissoluble in water, the other not dissoluble in that Liquor, but in Oyl; and though there be I know not how many other differences between them; yet

either of them single may be, and is, usefully employ'd for the Tinning of Brassie and Copper-vessels, each of them being endowed with a fitnessse to make Tin stick to those Metals, (as I elsewhere more particularly declare.) Thus, though Water, Sand, and Tin, are bodies in other respects very unlike, yet the two later are found fit to make Hour-glasses, as well as the first; though that alone, as is presum'd, were for many Ages employ'd by the Ancients for that purpose.

To the foregoing Advertisement I shall annex another, that may seem very differing from it, but yet is no lesse true; namely, that we are not alwayes to suppose, that because a Natural Body has such an Use on some occasions, the same Body cannot on other occasions be employed to Uses that seem of a quite differing, and perhaps of an opposite nature.

This I conceive may be done principally by these two wayes. First by the differing Constitutions of the severall Bodies the same Agent works upon; as when the heat of the Sun melts Wax and hardens Clay; and the same spirit of Vinegar, which on filings of Copper will by Digestion obtain an abominable Taste, will upon filings of Lead acquire by the same way a very great Sweetnesse: and spirit of Salt that will dissolve Copper and Iron, as *Aqua fortis* also does, will yet precipitate Silver dissolv'd in that Menstruum. And to this first way I shall subjoyn the *second*, which is, that such a parcel of Matter, as is wont to be consider'd as one and the same Body, may contain in it parts of very differing natures, upon whose account its Operations may be diversified. Thus when we calcine some unripe Minerals with Nitre, the inflammable parts of the Nitre do burn up and dissipate into smoak the volatile and combustible parts of the Mineral; but by virtue of the remaining Alcaly of the Nitre, severall other parts of the Mineral are made far more fixt and capable of enduring the fire, than they were before. So Sulphur has in it some parts that make it more readily inflam-

inflammable than even Nitre or Oyl ; and yet it abounds with acid and vitriolate particles that are not inflammable themselves, and much resist the Accension of Flame in divers other Bodies. And accordingly, though in Matches us'd in Tinder-boxes to take fire readily, the kindled Brimstone acts upon the shivers of Wood, whose ends were crusted over with it, as an ordinary flame; yet the same burning body, by virtue of its acid parts, works in another capacity, than that of a common flame upon some Metals, especially Iron, and likewise upon the Leaves of red Roses, which its Fumes turn white.

I could, if it were needful, propose in this place, sundry other Instances of the differing actions of the differing parts of a Body, and could likewise subjoyn other Cases, than I have yet mention'd, wherein Bodies may be applied to uses that many would be unapt to expect from them. But judging it more convenient to reserve those for other places, especially in the last Essay, I shall conclude this with the two following Advertisements.

The first is, That I have in all this Discourse purposely forborn to treat of the Medicinal uses of things, because my scope in the Volume, whereof this Essay is a part, oblig'd me so to do. But yet I am sensible, and would have you so too, that hereby I have forborn to employ a multitude of particulars, that would have much enrich'd this Treatise. For there is a great number of Bodies both Natural and Facitious, that being employ'd as Medicines for humane Bodies, have there very various and sometimes seemingly repugnant Operations, many of which would serve to illustrate and confirm sundry passages of this Essay. Thus Rhubarb, whether taken in Substance or Infusion, does by virtue of its differing parts, first purge and then bind. Spirit of Wine taken inwardly, exceedingly heats the Body; whereas outwardly tis employ'd to appease the heat caus'd by some hot humors

and inflammations. Mercury taken inwardly crude as it is, has often, though not alwayes, prov'd an effectual and harmeles Medicine in Worms, and some other Distempers, even to Children and Women in Labour: but the same Mercury rarified into fumes, (which yet may be condens'd again into running Mercury.) and in that form taken into the body, does too often cause vehement and dangerous commotions in the juices of the Body, as excessive Salivations, Fluxes, &c. declare. And he that shall attentively consider the various operations of that one Mineral Antimony, and the not onely differing, but oftentimes contrary Effects that it produces, according to the Complexions and Dispositions of the Taker's body, and the Preparation of the Mineral it self, will not, I presume, stick to allow me, That the Medicinal uses of things, if I had not thought fit to decline them in this Essay, might have much increas'd the number of Instances it contains; the effects of other Bodies upon those of Men being no less proper Instances of Natures wayes of working, than the changes they produce, when they work onely upon one another.

The second Advertisement (wherewith I shall conclude this Essay) is, That though what I have hitherto discours'd, hath almost solely related to the neglected uses of particular Natural Bodies: yet I would not have You thence take occasion to imagine, that there are not other Natural things whereof divers Uses may be made, that men have hitherto either ignor'd, or overseen. By *other Natural things* I mean *the differing states* of Matter, or of Bodies, (such as Rarity and Density, Fluidity and Firmness, Putrefaction and Fermentation, may seem to be,) as also *the more operative qualities*, such as Heat, Cold, Gravity, &c. *the Laws of Local Motion* among the parts of Matter; and *the present Fabrick* of the Universe, and especially that of our Terrestrial Globe and its Effluvia; to which might be added other things in Nature, that are not properly *Bodies* in the usual sense of that word, but may be called *Things Corporeal* as they belong to Bodies, and entirely depend on them. In favour of this Advertisement twere easie for me to suggest to You such a multitude of Particulars, that reserving some few for the last Essay, I here purposely forbear to mention any at all, to avoid being entic'd or engag'd to enter upon a subject, that could not be otherwise than very lamely handled, without enormously swelling an Essay, that does already exceed its just Dimensions.

